

SMOOTH-ON

HANDBOOK

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Mike Jackson, FAIA

Smooth-On Hand Book

Twenty-first Edition

A Guide to
the use of
Smooth-On
Cements

Smooth-On Manufacturing Company

Established 1895

Main Office and Works:
570-574 Communipaw Avenue
Jersey City, N. J., U. S. A.

Cable Address - "Smoothon Jersey City"
Codes: Private, Western Union and A. B. C. 4th and 5th Editions

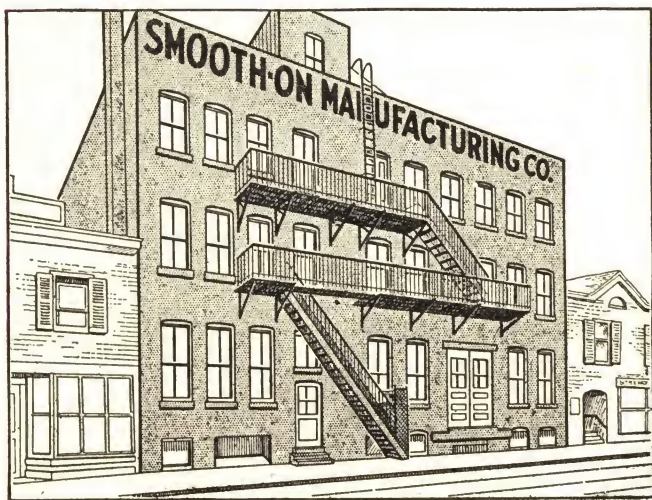
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SMOOTH-ON HANDBOOK

The Home of Smooth-On, Jersey City, N. J.



Office and Laboratory, 570-574 Communipaw Avenue



Works and Warehouse, 51-55 Harrison Avenue

SMOOTH-ON

REG. U. S. PAT. OFF.

SMOOTH-ON Iron Cements are made in powder, putty, paste and liquid form for convenience in using on different kinds of work. Each is made for special purposes as explained herein.

A careful study of the different kinds of Smooth-On and their application will prove interesting and profitable.

The illustrations on following pages, showing some of the many uses for Smooth-On Cements, are made from photographs or drawings of actual work. Names and addresses in connection with all specific applications will be furnished on request.

Engineering Service

As leading authorities on Iron Cements for over 30 years, our engineers are widely experienced, and well qualified to advise as to the correct use of Smooth-On under any conditions. This service is free for the asking.

Smooth-On Products

GENERAL characteristics of each kind of Smooth-On, principal uses and directions for applying will be found as indicated below, and typical applications are described in detail beginning on Page 18.

	Page
Smooth-On No. 1. } For stopping leaks and repair-	
Smooth-On No. 2. } ing breaks.....	4
Smooth-On No. 3. } For making pipe joints.....	6
Smooth-On No. 4a. } For use in foundry work.....	7
Smooth-On No. 4b. }	
Smooth-On No. 5. } For making hub joints.....	9
Smooth-On No. 6. } An iron putty.....	9
Smooth-On No. 7. } For waterproofing and harden-	
ing concrete, stone and brick-	
work, etc.....	10
Smooth-On Iron Concrete Paint	11
Smooth-On Corrugated Iron Gaskets	12
Smooth-On Pipe Clamps	14

NOTE: For average weights of Smooth-On per cubic foot; contents, sizes and weights of standard cases packed for shipment; and private telegraph and cable code, see Pages 14 to 16.

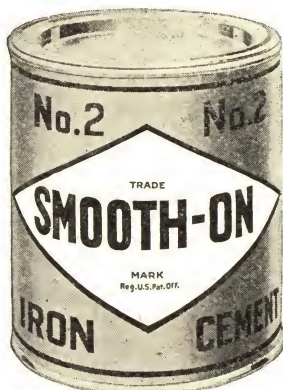
General Index: Pages 133 to 135

Smooth-On Nos. 1 and 2

Blue Label

No. 1 Quick-hardening

No. 2 Slow-hardening



Packed in 7-oz., 1 and 5-lb. cans, and 25, 50 and 100-lb. kegs

SMOOTH-ON Iron Cements No. 1 and No. 2 are made and sold in powdered form and used by mixing with water to the consistency of stiff putty.

When in this putty state, they must be applied immediately, because their metallizing action is rapid and in a few minutes they become too stiff to use. In a few hours they metallize as hard as iron, after which they expand and contract the same as iron—thus keeping a tight joint at all temperatures. Both Smooth-On No. 1 and Smooth-On No. 2 may be used for hot or cold work.

Smooth-On Iron Cement No. 2 is semi-hydraulic, which makes it valuable for use in damp places. After it has set, its hardening is increased and hastened by sprinkling with water.

Smooth-On Iron Cements No. 1 and No. 2 expand in metallizing and it is this action that makes them valuable for many mechanical uses.

Both No. 1 and No. 2 can be used on iron, steel, brass, copper, lead, aluminum, wood, etc., either alone or as a filling compound under a patch plate.

The principal uses include:

Stopping leaks of steam, water, fire, oil or gas in boilers, furnaces, stills, stoves, fire pots, condensers, tanks, pipes, etc.

Making tight seam, sleeve, screw or flanged joints in both new construction and repair work.

Repairing breaks or cracks in castings and spongy spots in porous castings.

Repairing gasoline-engine water jackets and radiators.

Making fire joints and smoke-stack joints.

Making anchor bolts and lock nuts tight.

Making loose handles tight, making loose screws hold in wood, etc.

Making screw-thread joints on caustic soda lines.

Directions for mixing Smooth-On Iron Cement No. 1:—Mix the desired amount of Smooth-On with water in bulk proportions of one of water to six of Smooth-On. At first the Smooth-On repels the water and the impulse is to add more water. Keep mixing the Smooth-On as measured until it becomes a stiff putty. The cement can then be worked in the hands as you would putty. Apply to the crack or defect, forcing the Smooth-On in with a hammer or putty knife until the opening is completely filled, then smooth over even with the surrounding surface. When Smooth-On becomes hard like iron, the repair is ready for use.

Directions for mixing Smooth-On Iron Cement No. 2:—Mix the desired amount of cement with water in bulk proportions of one of water to four of Smooth-On Iron Cement No. 2, which when thoroughly worked will become a stiff putty, in which state it may be pounded or forced into cracks or openings. A few hours after Smooth-On Iron Cement No. 2 has been applied, the metallizing is hastened and its hardening improved by sprinkling or dampening with water. This may be repeated two or three times, especially if the cement is in a dry place.

SUCCESSFUL performances of Smooth-On over a period of 30 years have made the name Smooth-On a household word from one end of the country to the other.

This wide distribution is in itself evidence of genuine merit, which is further proven by extensive sales of Smooth-On to such prominent users as the following:

United States Shipping Board Steamships
United States Navy and other Departments
Pennsylvania and New York Central Railroads
Standard Oil Company
Fire Department of New York City
Interborough Rapid Transit Co., New York
New York Edison Company
Public Service Corporation of New Jersey

Be the first to suggest Smooth-On and get the credit for the saving

Smooth-On No. 3

Gray Label

SMOOTH-ON No. 3 is an elastic iron cement made and sold in paste form, ready for use.

Being an oil mixture it hardens slowly, but the hardening can be hastened by heat. After thoroughly metallizing, it will withstand high pressure and heat of steam, water or oil, and expands and contracts the same as iron, therefore assuring tightness of the joint at all temperatures.



The principal uses include: Packed in 1 and 5-lb. cans

Making perfect screw-thread joints both in new construction, and with worn, battered, or corroded old threads.

Sealing seams and joints in boiler and other plate metal construction.

Cementing rivets and making stay-bolt fillets in boilers and tanks.

Coating metal and other gaskets and the faces of joint flanges, especially where gaskets alone do not make a tight joint.

Patching boiler plates, either alone or mixed with Smooth-On No. 1, and for either surface application or forcing under pump pressure.

Making joints for locomotive smoke boxes.

Repairing leaks in tin or iron roofs.

Directions:—Smooth-On No. 3 may be applied as a paint, paste or putty. For the two former, it need only be stirred to an even consistency before removing from the can, or if a thinner body is desired, linseed oil or kerosene may be added.

To apply as a putty, enough Smooth-On No. 1 or No. 2 should be added in powder form to give the desired consistency. This combination hardens in about the same time as red-lead putty.

Further procedure depends upon individual conditions, the more important of which are covered in later pages.

"Our experience with Smooth-On No. 3 for making screw-thread joints has been very satisfactory, and we have also found it very satisfactory in connection with gaskets, especially on high-pressure steam piping."—L.V. REESE, Chief Engineer, U. S. Metals Refining Co., Carteret, N. J.

Smooth-On No. 4**Yellow Label****Two Grades:**

No. 4a—For fine-grained castings

No. 4b—For coarse grained castings



Packed in 1 and 5-lb. cans, 25, 50 and 100-lb. kegs

SMOOTH-ON No. 4 is an iron cement prepared and sold in powder form. It is used for filling up blow holes and sand holes in castings, smoothing over surface blemishes and closing pores in spongy iron and steel castings. (See Page 103). It is also used for covering countersunk bolts, attaching ceramics to metal, forming a base for lead tank lining, etc.

Smooth-On No. 4 hardens or metallizes in from 1 to 24 hours, depending upon the size of the defect, and as the metallized filling is largely iron, it expands and contracts at the same ratio as the body of the casting. Once the filling is in and metallized, it stays in, with perfect surface and tightness.

Smooth-On Iron Cement No. 4a is the very best Iron Cement known for foundry work.

The peculiar qualities of No. 4a, its fineness and high percentage of metal, iron color and appearance, make it specially valuable for high grade, fine-grained castings that are to be highly finished or machined.

Where No. 4a is used, so thoroughly does it amalgamate with the casting that it is practically impossible to detect it. Having the same elements as iron, it expands and contracts in the same ratio as the body of the casting, hence it cannot work out. Once in, always in, with



These two circular surface sections were engraved from unretouched photographs—one of ordinary cast-iron—the other of metallized Smooth-On No. 4. It is practically impossible to tell which is which

perfect surface and working qualities, so that a casting treated with Smooth-On, even though pitted with blow-holes, is made substantially as good as a perfect casting.

By keeping a can of Smooth-On No. 4a on hand, you can save hundreds of dollars in the course of a year by making castings available that without Smooth-On No. 4a would inevitably find their way to the scrap heap.

Smooth-On Iron Cement No. 4b is a superior quality of iron cement made for castings where a high finish and fine texture are not imperative.

Directions for mixing and applying:—Mix the desired amount of cement with water in bulk proportions of one of water to six of cement, which when thoroughly worked or mixed will become a stiff putty. At first the cement repels the water, and the impulse of the inexperienced user is to add more water. Keep stirring the cement as measured six to one and it will soon become a soft pliable putty. Then work the cement in the hands as you would putty. Apply to the defect, pressing it in hard, smooth over the surface with a knife and allow to harden.

To repair a sand hole, crack or spongy spot, the putty should be spread over the defect, forced in by hammer taps and smoothed off to the surface level.

To repair a deep hole, the mixture should be applied in layers about $\frac{1}{4}$ -in. thick and each allowed to metallize before adding the next.

Caution:—Do not use too much water in mixing, or the result will not be satisfactory.

Smooth-On No. 5

Red Label

SMOOTH-ON No. 5 is a semi-hydraulic iron cement sold in powder form, for making caulked joints on plain or tarred cast iron or tile bell-and-spigot pipes in water and gas mains, heating and soil lines, etc. It hardens quickly and expansion in doing so makes the joint tight. (See Page 98)

Directions for mixing:—

Mix the required quantity of Smooth-On No. 5 with just enough water to make a stiff putty (seven parts Smooth-On No. 5 to two of water). Use oakum the same as when using lead. Apply Smooth-On to the joints and press it in until joint is filled. To harden sprinkle with water a few hours after the joint is made.



Packed in 1 and 5-lb. cans and 25, 50 and 100-lb. kegs

Smooth-On No. 6

White Label

SMOOTH-ON No. 6 is a plastic iron putty which comes ready for use. It is applied with a trowel or putty knife, hardens slowly and will not shrink or draw away from the joint, and is not affected by heat, cold, sun, rain or snow. The principal uses include:

Filling seams, rivet heads and other uneven places on iron and steel plates, wood or slate work, where a hard smooth surface is desired.

Making watertight joints on structural iron work, between iron work and concrete, and around chimney flashings on tin, wood and concrete roofs.

Placing and resetting glass against metal or wood, in window sash, skylights, vault-light frames, green-house sash bars, etc.

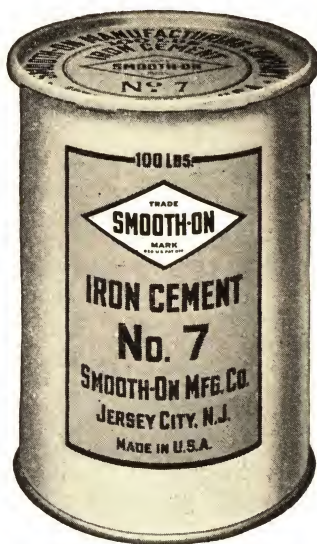
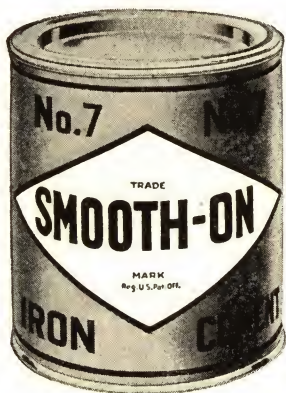
Making joints between paving flagstones and concrete blocks, either alone or in connection with oakum.



Packed in 1 and 5-lb. cans

Smooth-On No. 7

Red Label



Packed in 5-lb. cans and 25, 50
and 100-lb. kegs

SMOOTH-ON No. 7 is an hydraulic iron cement sold in powder form and used by mixing with water for application as a cement or paint.

It is used alone, in combination with portland cement, or with portland cement and sand, principally for the following purposes:

- Making extra hard water-tight non-dusting concrete floors, roofs, and engine and other machinery foundations.
- Making hard, waterproof, heat-resisting floors under and in front of boilers.
- Resurfacing old wooden floors or tank walls to give a concrete surface effect.
- Patching concrete, brick or stone floors.
- Repairing waterworks reservoirs and filtration beds where porosity or cracking has caused leakage.
- Waterproofing and weatherproofing concrete, brick or stone walls and chimneys, by either outside or inside application.
- Repairing cracks and holes in concrete, brick or stone work.
- Oil-proofing and gasoline-proofing concrete tanks.
- Making waterproof surfaces and joints in underground or sub-aqueous construction, as in tanks, sumps, wheel, pump and other machinery pits, etc.

(Directions for application, see Pages 105 and 106.)

Smooth-On Iron Concrete Paint

SMOOTH-ON Iron Concrete Paint is a fluid preparation of Smooth-On Iron Cement, made only in dark gray, the color of Smooth-On Iron Cement, for surfacing concrete floors, roofs or walls, to prevent dusting, to make them waterproof and to improve their wearing quality.

When Smooth-On Iron Concrete Paint is applied to concrete surfaces it penetrates the surface and then sets or metallizes. This action bonds the Smooth-On to the concrete and makes a hard wearing surface of iron.

One application of Smooth-On Iron Concrete Paint under ordinary conditions will stop the dusting of concrete floors and make them waterproof. For severe cases where two applications are necessary, three days should elapse between first and second applications. The floors may be used 24 hours after the Smooth-On Iron Concrete Paint has been applied.

If the concrete floor or wall contains holes, uneven places or granulated concrete, these places must be repaired with Smooth-On Iron Cement No. 7 before the application of Smooth-On Iron Concrete Paint.

Directions:—The floor must be made clean and dry, after which the Smooth-On Iron Concrete Paint should be applied with a stiff brush and worked well into the concrete.

Smooth-On Iron Concrete Paint is very desirable for painting the concrete of vault lights, to make the concrete waterproof and fill all openings between concrete and glass. It is also successfully used for painting expansion joint seams on roofs.

Each gallon weighs 21 lb. and under average conditions will cover 200 sq. ft. with one coat.



Packed in $\frac{1}{2}$ and 1-gal. tins

Smooth-On Corrugated Iron Gaskets

The best gaskets made for flange joints for any pressure or temperature, for steam, water, oil, air or ammonia

SMOOTH-ON Corrugated Gaskets are made from sheets of iron, specially prepared and rolled with concentric corrugations. The gasket is furnished coated with Smooth-On Iron Cement No. 3, or uncoated, as desired.

All Smooth-On Gaskets whether coated or uncoated, should be painted with Smooth-On No. 3 just before the gasket is used. The soft coating will flow over the surface of the gasket and fill all uneven places in the flange faces.

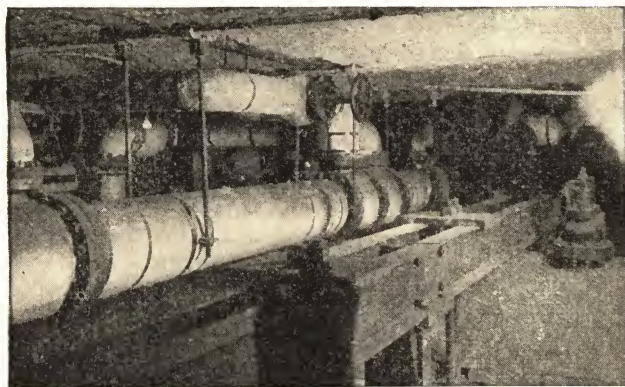
After the flanges are bolted and steam is turned on, the bolts should be tapped lightly with a hammer to settle them, and then given a final tightening.

A Smooth-On Gasket expands and contracts the same as iron with alternate high and low temperatures.

Joints can be taken apart easily by loosening bolts and inserting a thin knife between the gasket and faces on each side.

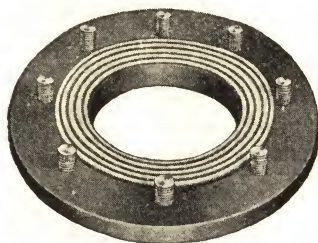
When the surfaces of the flanges are uneven or pitted, the uneven places should be filled with Smooth-On No. 1.

We make both narrow-width and full-width gaskets for each size flange. The narrow-width gasket covers the sur-

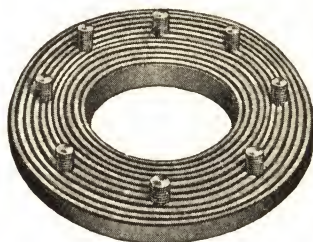


168 Smooth-On Gaskets—all tight:—Two years after this 1400 h.p. plant (Brooklyn, N. Y.) had been equipped with 168 Smooth-On Gaskets in the boiler lines, not a single gasket leak had developed. The engineer wrote us: "*I consider this remarkable as our piping is intricate. Smooth-On Gaskets are certainly great insurance against leaking flanged joints*"

face of the flanged faces inside the bolt line circle; the full-width covers the full surface of the flanged face. We advise the narrow-width, as only from three to four corrugations are necessary to make a joint.



Narrow-width Gasket



Full-width Gasket

Dimensions of Smooth-On Gaskets

Pipe size (inches)	For pressures up to 200 lb.		For pressures up to 250 lb.	
	Full width gasket (inches)	Narrow gasket inside bolt holes (inches)	Full width gasket (inches)	Narrow gasket inside bolt holes (inches)
2	2 x 6	2 x 4		
2½	2½ x 7	2½ x 4¾	2½ x 7½	2½ x 5
3	3 x 7½	3 x 5¼	3 x 8½	3 x 5⅞
3½	3½ x 8½	3½ x 6¼	3½ x 9	3½ x 6½
4	4 x 9	4 x 6⅝	4 x 10	4 x 7
4½	4½ x 9¼	4½ x 6⅞	4½ x 10½	4½ x 7⅝
5	5 x 10	5 x 7⅝	5 x 11	5 x 8⅜
6	6 x 11	6 x 8⅝	6 x 12½	6 x 9¾
7	7 x 12½	7 x 9⅞	7 x 14	7 x 10⅞
8	8 x 13½	8 x 10⅞	8 x 15	8 x 12
9	9 x 15	9 x 12⅝	9 x 16	9 x 13
10	10 x 16	10 x 13¼	10 x 17½	10 x 14¼
12	12 x 19	12 x 16	12 x 20	12 x 16¾
14	14 x 21	14 x 17⅝	14 x 22½	14 x 19
15	15 x 22¼	15 x 18⅞	15 x 23½	15 x 19⅞
16	16 x 23½	16 x 20⅞	16 x 25	16 x 21⅜
18	18 x 25	18 x 21½	18 x 27	18 x 23⅜
20	20 x 27½	20 x 23¾	20 x 29½	20 x 25½
22	22 x 29½	22 x 25⅞	22 x 31½	22 x 27½
24	24 x 32	24 x 28½	24 x 34	24 x 30
26	26 x 34¼	26 x 30⅝		

Prices on application

Smooth-On Pipe Clamps

THESE clamps provide a means for permanently sealing leaks at the screw-threads of pipe joints, at threaded inlets and outlets of pressure containers, etc.

All sizes are cast in halves for convenience in encircling the pipe and are held together by set screws or bolts. Equi-distant inner spacing lugs keep the band concentric with the pipe and provide a uniform annular space into which Smooth-On No. 1 is tamped around the pipe surface and against the threaded joint end. All sizes are so proportioned that if used in connection with threaded flanges and set close against the flange, the band will not interfere with the flange bolts.



Smooth-On Clamp

Typical application of Smooth-On Clamps is explained and illustrated on Pages 21 and 22. A small convenient tamping tool, as shown there, is furnished with each clamp.

Smooth-On Clamps are carried in stock for all pipe sizes from 1-in. to 12-in. inclusive. In ordering, state whether size given is the nominal pipe size, or the actual outside pipe diameter.

Amounts of Smooth-On No. 1 for various sizes of
Smooth-On Clamps

Pipe size	Amount of Smooth-On	Pipe size	Amount of Smooth-On	Pipe size	Amount of Smooth-On
1 In.	1 Oz.	3½ In.	8 Oz.	8 In.	1 lb. 7 Oz.
1¼ "	1½ "	4 "	9 "	9 "	1 " 9 "
1½ "	2 "	4½ "	10 "	10 "	2 " 3 "
2 "	4 "	5 "	11 "	11 "	2 " 6 "
2½ "	5 "	6 "	14 "	12 "	2 " 8 "
3 "	7 "	7 "	1 lb. 4 Oz.		

Contents, sizes and weights of standard cases packed for shipment

Kind of package	Kind of Smooth-On	How packed	Outside dimensions (inches)	Net weight (lb.)	Approx. gross wt. (lb.)
Whole cases	Smooth-On No. 1, 2, 4a, 4b, 5 or 7	60 1-lb. 12 5-lb.	18 x 15 x 8 16½x10x11	60 60	79 72
	Smooth-On No. 3 or 6	60 1-lb. 12 5-lb.	18 x 15 x 6 16 x 10 x 8	60 60	75 74
	Smooth-On No. 1	144 7-oz.	23 x 13 x 10	63	108
Special cases	Smooth-On No. 1, 2, 3, 4a, 4b, 5 or 6	12 1-lb. Booklets Display card	9 x 7 x 7	12	17
Steel pails	Smooth-On No. 1, 2, 3, 4a, 4b, 5, 6 or 7	25-lb.	8 x 8	25	27
Steel Kegs	Smooth-On No. 1, 2, 4a, 4b, 5 or 7	50-lb. 100-lb.	10 x 10 11 x 13	50 100	54 108
Sacks	Smooth-On No. 7	100-lb.	12 x 15	100	103

Average weights of Smooth-On Iron Cements

Kind of Smooth-On	Weight in lb. per cu. ft.	Weight in lb. per cu. in.
Smooth-On No. 1	Dry 193	0.11
Smooth-On No. 2	Dry 193	0.11
Smooth-On No. 3	Paste 250	0.145
Smooth-On No. 4a	Dry 184	0.106
Smooth-On No. 4b	Dry 184	0.106
Smooth-On No. 5	Dry 170	0.098
Smooth-On No. 6	Putty 235	0.136
Smooth-On No. 7	Dry 160	0.093

Telegraph and Cable Code

Cable address: "SMOOTHON JERSEY CITY"

Codes: A.B.C., 4th and 5th Editions: Western Union

THE following private code will be found convenient for ordering Smooth-On.

Orders and shipments

Ship by steamer.....	WATER
Ship by express.....	MOTOR
Ship by railroad.....	STEAM
Send us shipping particulars our order.....	WAYBL
Have you shipped our order of (number).....	ADJUS
Your order was shipped.....	OCEAN
Duplicate our order of (number).....	DULTE
How soon will you ship.....	SONWL
Shipped as per your instructions.....	INSTR
As soon as possible.....	BELLO
Telegraph or cable at once when you will ship.....	HAPPY
Trace your shipment of our order of (number).....	RACER
F.O.B. New York.....	BOARD
We have opened credit in your favor.....	FAVOR
Answer by telegram.....	BAYOU
Answer by cable.....	SWORD
Have written you this day.....	MONAD

Kinds of Smooth-On

Smooth-On Iron Cement No. 1.....	ADMIT
Smooth-On Iron Cement No. 2.....	BADGE
Smooth-On Iron Cement No. 3.....	CADDY
Smooth-On Iron Cement No. 4a.....	DECOY
Smooth-On Iron Cement No. 4b.....	EQUIP
Smooth-On Iron Cement No. 5.....	FAITH
Smooth-On Iron Cement No. 6.....	GAVEL
Smooth-On Iron Cement No. 7.....	HUTCH
Smooth-On Iron Gaskets.....	IDIOM
Smooth-On Iron Paint.....	JAUNT
Smooth-On Pipe Clamps.....	LAMPC

Sizes of packages

Whole cases 7-oz. cans Smooth-On No. 1, 1 gross.....	KAYAK
Whole cases, 1-lb. cans, 60-lb. net.....	LOUGH
Whole cases, 5-lb. cans, 60-lb. net.....	GEDBA
25-lb. pails.....	LAVGE
50-lb. Kegs.....	MACAW
100-lb. Kegs.....	GREAT

Severe conditions under which Smooth-On Cements give exceptional service

HIGH temperatures:—Every test will prove the astonishing ability of Smooth-On to withstand very high temperatures, even up to direct furnace heat.



Bottom

Top

Test showing the resistance of Smooth-On No. 1 to direct furnace heat. Although the lower flange melted away, the Smooth-On in the joint almost completely retained its color, texture, original shape and general good appearance. See text

A flanged pipe connection packed with Smooth-On No. 1 (illustrated above), was on a line that dropped into hot coals during a fire. The lower flange was entirely melted away, but the Smooth-On with which the joint was packed protected the upper flange so well that it was practically undamaged except at one edge.

In another instance, a 4-in. by $\frac{1}{8}$ -in. crack in the engine cylinder water jacket of a large tractor at Saskatoon, Canada, had been repaired with Smooth-On. At a later date, scoring of a cylinder wall necessitated building up by the oxy-acetylene welding process, and then grinding back to a true circle.

When in the welding process, the cylinder block was heated to a dull red, the engineer said good-bye to the Smooth-On repair, but he was agreeably surprised. The old repair held perfectly and after another summer, the engine was still in excellent condition.

High pressures:—Smooth-On, properly applied, can safely withstand any pressure met in modern power plant service. A manufacturer in Auckland, New Zealand, used it with great success on an air compressor working up to 1,400 lb. per square inch and on Page 80 will be found reference to a successful application on a 60-ton hydraulic accumulator in which 850-lb. pressure is maintained.

Making screw-thread joints

LEAKS at screw-thread joints can be a source of serious loss—in pressure and fluid wasted, damage from escaping vapor and drips, and time and trouble for repairs. Screw-thread joints therefore should be kept off the repair list.

The faults which produce most leaks at screw-thread joints, as shown on Page 19, may be overcome by making screw-thread joints with Smooth-On No. 3, because:



Smooth-On No. 3 as a filler for screw-thread joints is ready to use as it comes from the original package. It should be painted onto the male thread so that surplus is pushed *outside* instead of *inside* the line

First: It lubricates during assembling, and helps to bring the connecting parts tightly together.

Second: It completely fills all voids shown in black on Page 19 and prevents leakage because it has the same expansion and contraction with heat and cold as the pipe.

Third: It is equally impervious to water, gas, steam, air and many chemical fluids. It cannot dry or blow out, shrivel, shrink, crack or leak under the most violent temperature (superheated steam) and pressure changes, nor will any number of years of service impair its effectiveness.

Fourth: Although tight for the life of the line, the joint can still be taken apart, if necessary in altering the plant layout, or for periodical internal inspection.

"I tested Smooth-On No. 3 on hot water coils that had to be changed every four weeks. Because of the confined location, the fittings on these coils had been hard to open. After using Smooth-On No. 3 as a joint filler, very little effort was required to start the unions."—R. M. BRATTON, Newkirk, Okla.

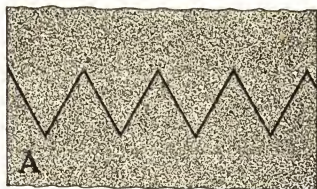
Joints in brass piping:—Brass piping, now very popular for supply lines in buildings, does not corrode. A small screw-thread leak in iron pipe may rust itself shut, but with brass pipe, leakage once started, never grows less. The use of Smooth-On No. 3 on all threads *from the start* should therefore be standard practice.

Oil and gasoline lines:—Smooth-On No. 1 and Smooth-On No. 3, when metallized are entirely neutral to gasoline and hot or cold oil. Either may therefore be used on these lines with assurance of absolute and lasting tightness, even where no other joint compound has been found able to hold.

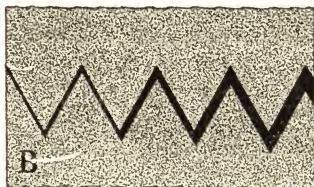
Why Smooth-On No. 3 is necessary for screw-threaded pressure-joints:—If theory and practice agreed, all main thread contacts would be alike (A in the diagrams), and the thin film of filling between the threads would have little to do.

This condition, however, is rare. One or a combination of the faults shown as B to G usually exists, and each works against pressure-tightness.

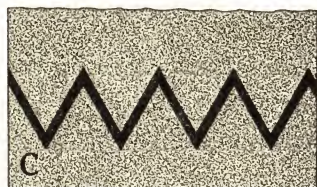
Unless these voids are filled with a material which has the permanence of Smooth-On No. 3, leakage is almost sure to develop



A. Correct but rare



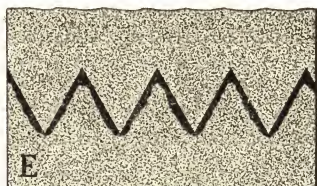
B. Unequal taper



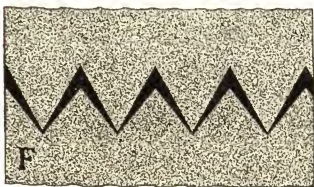
C. Threads undercut



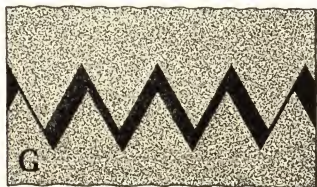
D. Threads battered



E. Threads rusted



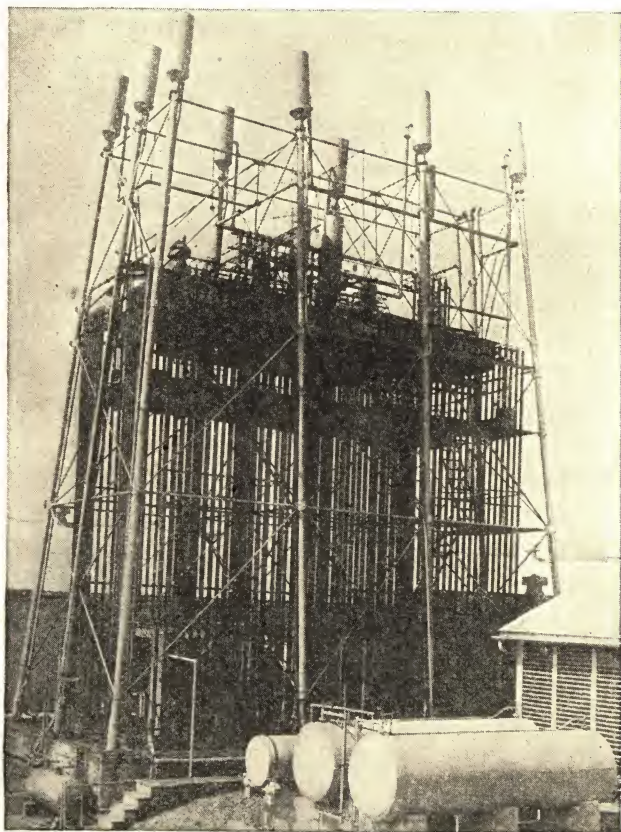
F. Differing face angles



G. Pitch unequal

That Smooth-On No. 1 is thoroughly successful under these conditions was proven by a Tulsa, Okla. builder of heat exchangers and stills directly fired by residue gas, for extracting gasoline from natural gas.

Their installation, for a prominent oil company as shown, is typical. The heat exchangers are formed from 2-in. pipes placed within 3-in. pipes. Cold oil enters the inner pipe at the bottom and leaves at the top at 160 deg. fahr., and through the annular space between the two



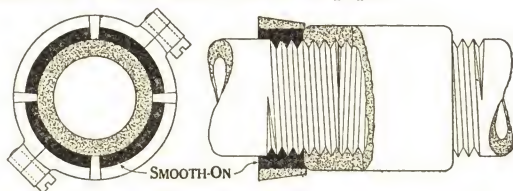
Heat exchanger with still fired by natural gas. The threaded joints on all hot and cold oil pipes have held perfectly since made with Smooth-On No. 1, but were never tight before

pipes, hot oil entering at the top at 450 deg. fahr. flows to the bottom and is reduced to 100 deg. fahr. Manifolds at top and bottom combine the circulating pipes into units, which are connected to the stills by pipes.

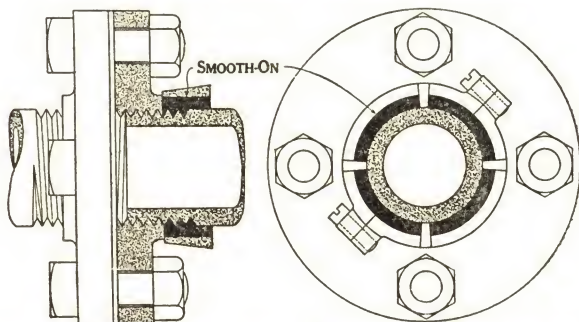
Litharge and glycerine were used at first for making all screw-thread connections, but the joints soon began to leak. Smooth-On No. 1 has since been successful on the screw-thread joints for both hot and cold oil, where all other fillers failed.

Caustic Soda Lines:—Smooth-On No. 1 is unequalled for screw-thread joints on caustic soda lines because it is not affected by alkali.

Stopping leaks at screw-threads of pipe joints:—Screw-thread leaks can be quickly, cheaply, and permanently stopped by applying Smooth-On No. 1 under a Smooth-On Pipe Clamp (see Page 14). These clamps are made for all standard sizes of pipe.



Smooth-On Clamp applied to a plain coupled joint



Smooth-On Clamp on a flanged joint. The clamp does not interfere with flange bolts

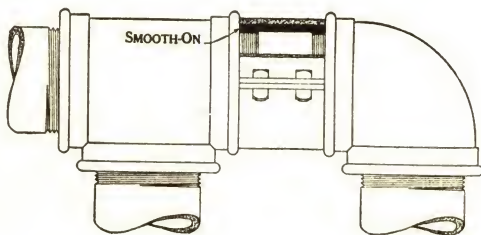
The Clamp should be put around the pipe, with bolts a quarter turn from the leak, and with flat edge against the coupling or flange, shoved firmly against the fitting



Tool for tamping in the Smooth-On, and the way it is used

and bolted tight. Smooth-On No. 1, mixed with water to form a stiff putty, should be packed into the annular space between pipe surface and inside of clamp. When this space is completely filled, the Smooth-On should be caulked with the tool furnished with each clamp, for that purpose. The expansion of the Smooth-On in hardening makes a tight joint between the clamp and pipe and stops all leakage. A repair so made lasts as long as the rest of the line.

Stopping leakage at the screw threads of short nipples:—The expense of taking down the line to stop leakage at the screw threads of a nipple which is too short to permit the use of a Smooth-On Pipe Clamp, can be avoided by utilizing the method shown above. A strap-



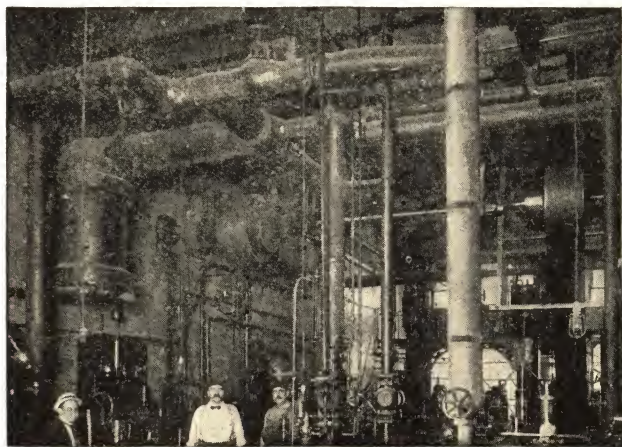
Smooth-On No. 1 used under a flat band to stop leakage at the screw threads

iron band is made in halves and cut to a close fit between the fitting and coupling ends. The inside band surfaces and the outside of the nipple are covered with a layer of Smooth-On No. 1. Upon placing the band, drawing the bolts tight on both sides and allowing the Smooth-On to set, the repair will be tight and permanent.

Leaks at screw-threads on main headers and other high-pressure steam lines:—One of the largest boiler insurance companies states that boiler-room steam headers without leaks are the exception rather than the rule, but cautions that such leakage is a bad sign and ought to be stopped as soon as it starts.

High-pressure steam leaks can usually be stopped by closing valves on both sides of the leak while full pressure is on the pipe, and then painting Smooth-On No. 3 over and beyond the leak as soon as the steam stops blowing. Partial vacuum caused by condensation of the steam within the pipe, will draw this Smooth-On No. 3 into the leak and more should be applied as it is drawn in.

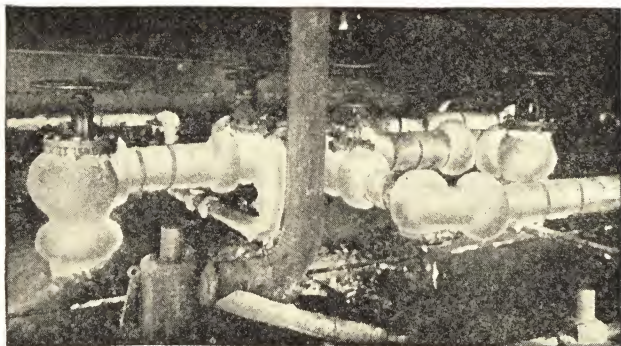
Particularly prompt attention should be given to high-pressure steam leaks which develop a violent flow, both on account of the steam loss, and the cutting action of solid impurities carried in the steam. The latter will "wire-draw" a channel through threads in a surprisingly



Joint leak stopped while under steam pressure:—A bad steam leak developed in this plant at Queens, N.Y., in the main line where a 12-in. pipe was threaded into a cross tee. Caulking several times with copper and other metals was of no avail.

To take the pipe down would have involved heavy expense, so the pressure was dropped to 40 lb. and Smooth-On applied. The leak stopped in a few minutes and never came back.

The next day an 8-in. ell with steam at 90-lb. blowing out was made tight in the same way and that too never leaked again. The Engineer who made these two repairs, stated that he surprised himself at the good results in both instances



15 Leaks in these lines were stopped permanently by reassembling the threaded joints after painting all threads with Smooth-On No. 3

short time and leakage increases at an alarming rate.

The engineer in a large school building in Chicago had a leak on a main carrying 100-lb. pressure. This started on a cold day, and the leak developed so fast that dismissal of 2,000 children was considered. It was stopped in less than an hour's time with Smooth-On No. 1. The repair proved perfectly tight for years afterward, and as far as we know is still in good condition.

Proper application of Smooth-On in such cases, will invariably check the erosion and leakage at once, and generally avoids excessive shutdown and the expense and hard labor of putting in new pipe and fittings.

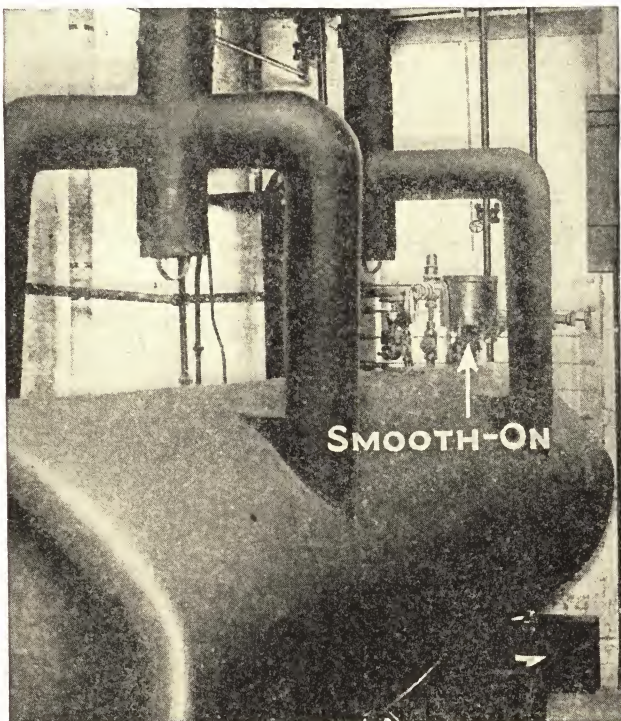
Where a line contains many obstinate leaks at the screw-threads, it is desirable protection against sudden future breakdown to disassemble the whole line, wire-brush and clean all threads, apply Smooth-On No. 3, and in reassembling, make sure that any steam-cut grooves through the threads are staggered.

The wisdom of this policy was proven at an electric light plant in Casselton, N. D., where at one time the 12-in. and 8-in. steam mains from the two 150-hp. boilers leaked at almost every flange where the piping was screwed into the flanges.

The escaping steam condensed on the roof ceiling and moisture-soaked the wooden parts of the entire building. The outer walls, doors and windows were at times frozen solid and the damage to the structure was severe. Caulking and welding at the leaks had failed to better conditions, so one Sunday the plant was shut down for six

hours, and with the help of several men every leaky joint was taken down. All threads were painted with Smooth-On No. 3 before reassembling. Two years later, not a single leak had developed, nor had a minute's time been spent on the steam mains.

Similar conditions at one time prevailed in a plant at

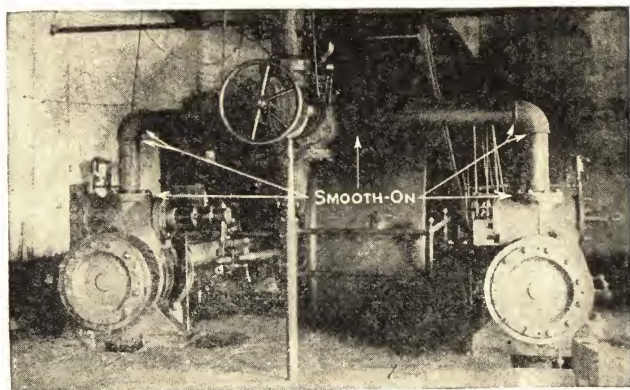


Ammonia leaks stopped by Smooth-On No. 1:—This ammonia generator located near Asbury Park, N. J., leaked so badly that the City Council was about to declare it a nuisance and forbid further operation.

The trouble came largely from faulty threads at a nipple at the point of the arrow in the photo. Litharge and glycerine fillings on the threads and tightening with a wrench were of no avail, so welding was considered at a cost of about \$100.00. This would have involved draining off the ammonia and ripping off insulating blocks and coverings, in addition to cutting out the old nipple. Smooth-On No. 1 applied under a strap as shown on Page 22 and without any disassembling stopped the leak completely

Kingman, Kans. There were 15 thread leaks in the 4-in., 5-in., and 6-in. steam mains. The leaks were so bad that on cold days condensation fairly rained from the boiler-room ceiling.

The Chief Engineer took down the whole outfit, put Smooth-On No. 3 into the threaded joints, and afterward these lines carried the pressure (120-lb.) without a leak. The Engineer, after experience with various pipe dopes and cements, told us that only Smooth-On could have stopped these leaks without new flanges and pipe.

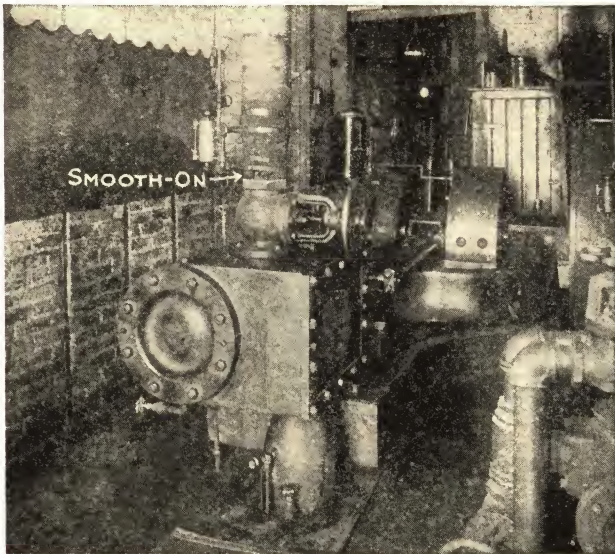


Inlet piping made tight with Smooth-On No. 3

Stopping screw-thread leaks at steam-engine inlets:—Connections on engine intake lines and short threaded nipples between throttle and steam separator are often subjected to considerable vibration as well as extreme temperature changes, both of which tend to promote leakage at these locations.

Laying up the threads at the start with Smooth-On No. 3 or disassembling and doing this later is the best permanent protection against leakage at these points, as indicated by the following cases:

The 6-in. intake pipes of a 20-in. by 24-in. rocker-valve type twin engine (shown above) in a plant at New Willard, Texas, leaked badly. The leaks had been caulked until caulking would no longer keep steam from blowing. On taking the intake outfit apart, bad and broken threads were found between some of the flanges and their connecting pipes. The joints were remade with Smooth-On



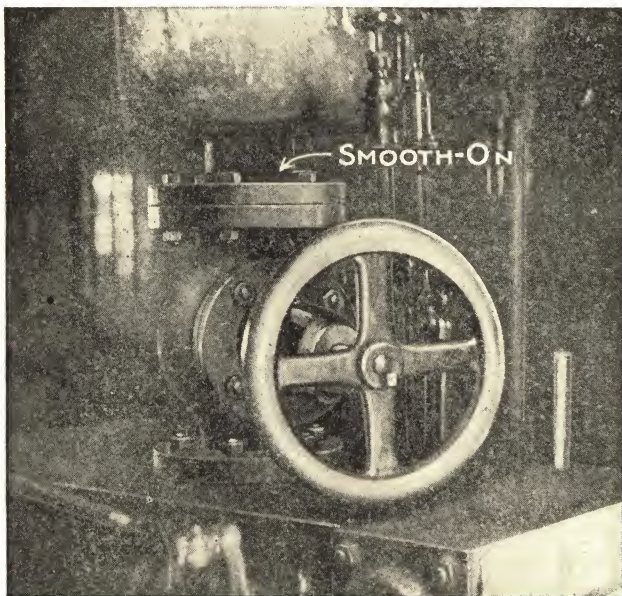
Leakage at the connection between throttle and line of this engine could not be completely and permanently stopped until Smooth-On No. 3 was applied to the threads

No. 3. Three years later these joints were still perfectly tight under 125-lb. pressure.

In the second instance, a bad thread leak (see picture above) between the throttle and the 5-in. steam line to an engine in Gaylord, Mich., was hard to keep tight on account of vibration. The Engineer tried everything he could think of but couldn't stop the leak until he reset the threads in Smooth-On No. 3. Three years later no further leakage had developed.

Of course, disassembling is to be avoided wherever possible and it *can* be in many instances by using a Smooth-On Clamp as described on Page 21 or the flat band shown on Page 22. Another procedure was suggested by an Engineer in N. Baltimore, O., as follows: A connection between 5-in. main and the engine steam chest had been put together by incompetent men, and was leaking so badly that condensation from the escaping steam impaired belt friction and even threw belts off. To dismantle the steam line was out of question, so the gate valve was closed at the boilers, to cool the line and form a vacuum inside as the steam condensed. The threads were

then cleaned where steam had been escaping, and Smooth-On No. 3 was quickly applied in paste form so that the vacuum would help to pull it into the opening. The repair was given three-quarters of an hour for the Smooth-On to set, and steam was turned on. The mill was started after a shut-down lasting less than an hour and a quarter. Four years later the Smooth-On repair was holding as well as ever, and had never leaked.



A weak thread caused leakage at this short nipple between steam separator and engine throttle valve in a plant at Washington, Mo. To break joints and take down line and separator would have been a nasty undertaking, but necessary in installing a new nipple. This it was figured would cost about \$32.00, so the Engineer insisted upon trying Smooth-On No. 1. The repair took 15 minutes and two tablespoons full of Smooth-On. Seven years afterward, this nipple had been in constant service under 150-lb. pressure without the least sign of leak, and appeared still good as ever

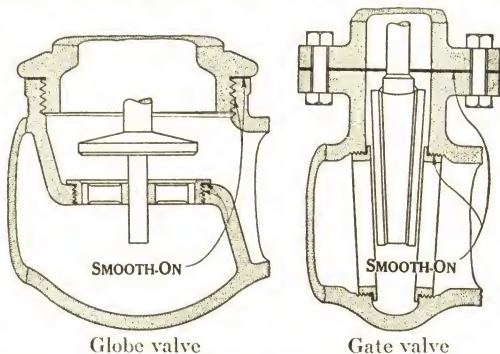
Stopping leaks in heating coils:—Heating coils develop leaks principally from strain due to pipe sag and as they get older, from corrosion and pitting, especially where located in moist air as in greenhouses. Where the heating system is of the steam vacuum type, all the joints

should be coated with Smooth-On No. 3 which will be drawn in by the vacuum, and will seal the leaks.

With low-pressure heating systems, leaks at the joints can be stopped by filling the system with steam, closing the valves and allowing the steam to condense to form a partial vacuum. Smooth-On No. 3 applied to the faulty joints will then be drawn into the leaks.

Another method is to apply Smooth-On No. 1 to the leaky fittings, under Smooth-On Clamps or any retaining bands as instructed on Pages 21 and 22.

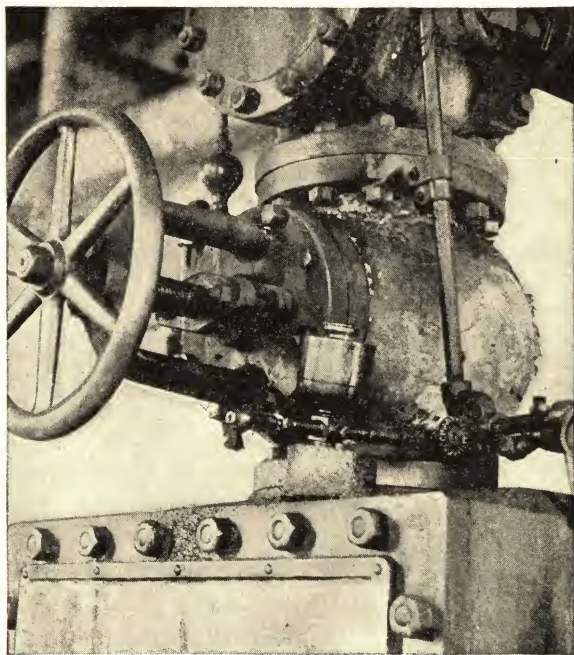
Making renewable seat rings tight at the threads:—Renewable seat rings in globe, angle, check and gate valves and in the valve decks of reciprocating pumps can be kept from twisting or wearing loose and leaking at the threads by making the threaded joint with Smooth-On No. 3.



In cases where steam has wire-drawn and cut grooves into the threads of old rings, or where an up-and-down movement of the ring on its seat has badly worn the threads, Smooth-On No. 1 will fill the voids and make a perfectly tight joint, thereby utilizing the old ring for further service and avoiding the necessity of replacing the valve body or reboring and retapping for a new oversize ring.

The Engineer in a large plant in Washington, D. C. has such repairs in use over three years and cites in particular, one in the seat ring of a 6-in. two-way automatic stop valve. In this instance, Smooth-On No. 1 made the valve perfectly tight under 150-lb. pressure and saved the cost of a new valve or at least the cost of a new body.

In another instance, at the Pittsburg, Kans. Waterworks, steam had cut its way between the iron body and

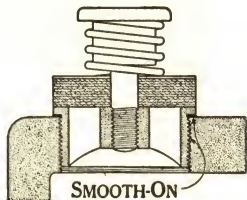


Setting the leaky seat ring in this valve with Smooth-On No. 1 saved about \$240.00:—Leakage at this throttle valve at Anderson, Ind., became worse and worse until the automatic stop valve in the line had to be used to shut down the engine at the close of the day. Steam was found to have cut a passage approximately $1\frac{1}{2}$ -in. long through the threads between the renewal seat and the valve body. A new valve would have cost \$225.00 plus the labor and at least a day's plant shut-down during a period of peak production. The Engineer made a perfect repair by filling the eroded passages with Smooth-On No. 1 and resetting the seat ring threads with a thinner filling of the same material. The total cost of the Smooth-On repair including labor was \$1.40. Six years later the valve was giving as good service as ever

brass seat of an extra heavy 6-in. globe valve, used as the throttle and always under steam pressure, on an emergency fire pump. Smooth-On No. 1 stopped the leak and saved the cost of a new valve, as well as avoided the danger of having the pump out of commission.

What may be accomplished with a leaky loose pump valve seat ring was demonstrated by the Engineer in a

Philadelphia plant. The pump which was the mainstay for boiler feeding there acted queerly, and one day ceased to deliver at all. On removal of the head from the water end, the valve seat was found loose in the deck, and in working up and down, had worn the threads so they would not hold at all. An oversize seat could not be obtained promptly from the pump builders, and getting one locally would have involved making a pattern, and waiting for a casting which would still have to be machined.



Pump valve held in deck with Smooth-On No. 1

The old seat was cleaned, reset with Smooth-On No. 1 and left to stand over night. Next morning the plant started up on time, and the pump has for three years since delivered at 125-lb. pressure and 200 deg. fahr. temperature, with the Smooth-On repair apparently tight as ever.

Preventing or stopping leaks between valve bodies and tops:—Leaks at joints between body and bonnet of globe, angle and gate valves and between body and cap of check valves can be prevented or stopped by coating the threads or the gasket of the joint with Smooth-On No. 3 as shown in the illustrations on Page 29.

Making flanged Joints

See also Boiler Handhole and Manhole Covers, Page 52, and Blow-off Connections, Page 51.

THE coating used on a gasket in many instances determines the success or failure of the joint. Smooth-On No. 3 is without equal as a coating for any gasket. When painted on and the gaskets bolted up while the Smooth-On is wet, it flows to the places where most needed.

After gaskets are bolted into the flanges and steam turned on, the bolts should be tapped lightly with a hammer to set the nuts and metal in the joints, after which the nuts should again be taken up.

Joints so made are thoroughly tight on flat-face, raised-face or van stone flanges and can be easily taken apart by loosening the bolts and inserting a thin knife between the gasket and faces on each side.

If pits or uneven spots exist in the flange bearing surfaces, they should be filled in with Smooth-On No. 1 before placing the gasket. This will usually minimize the danger of future leakage or blow-out and is as effective as purchasing and placing new flanges.

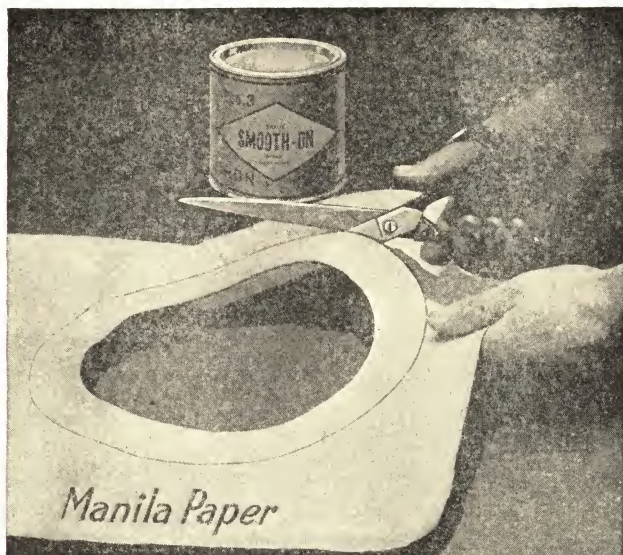
Filling a sand hole in the flange of a van stone joint in this way at Parlin, N. J. restored pressure tightness at 150 lb. and saved a 40-ft. length of 10-in. pipe and eight hours work for a gang of men.

Similar efficiency was shown on a 14-in. steam header carrying 150-lb. pressure at Wellston, Ohio. A gasketed joint here had been leaking for four months before a new gasket was put in. On taking the flanges apart, the faces were found to be steam-cut with grooves, some of which were $\frac{1}{16}$ in. deep. Taking out the flanges and trueing them up would have involved at least a 12-hour shut-down. Instead, the flanges were cleaned, the grooves were filled with Smooth-On No. 1 and leveled to a true face. On putting in the gasket, the leak stopped and after five years was still steam tight.

Gaskets:—Smooth-On No. 3 will give exceptional service in connection with any corrugated metal, asbestos, fiber or rubber gasket.

Smooth-On Corrugated Iron Gaskets (see Page 12) are recommended as they are made specially for use with Smooth-On and will stay tight under the excessive expansion and contraction of the widest temperature range. That these gaskets will stand any test may be inferred from their perfect performance when subjected alternately to highly superheated and saturated steam. An independently fired superheater at Chrome, N. J., was subjected to both superheated and saturated steam. No gaskets had been found satisfactory on both services. Four months after installing Smooth-On Gaskets, the Superintendent conceded that they and they alone had met all conditions. Five years after that, the Smooth-On Gaskets were still tight.

Making gaskets from wire gauze or paper and Smooth-On No. 3:—An entirely satisfactory gasket, for emergency or otherwise, can be made by cutting a piece of thin cardboard, manila paper or light wire gauze to fit the flange and coating liberally and evenly on both sides with Smooth-On No. 3. This combination will



To make a good gasket, only a sheet of manila paper, cardboard or wire gauze, a pair of scissors, a can of Smooth-On No. 3 and a brush for applying the Smooth-On are needed

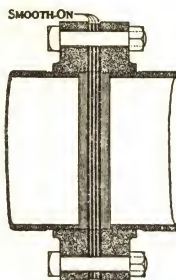
stand a temperature of at least 1,200 deg. fahr. without injury and actually improves with age.

If one gasket so treated is not enough, as many more as needed to bulk up to correct thickness may be used. The paper or gauze merely acts as a binder to hold the Smooth-On where it will work into and fill all the uneven places and form a seal.

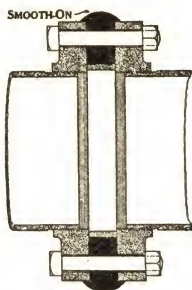
This idea has "saved the day" many a time when a leaky gasket had to be replaced in a hurry and no gasket of the right size and no sheet packing were available.

Flanges that do not come together:—In rearranging old mains and assembling pipe and units that are not well measured and fitted, the flanges may not fully meet.

The intervening space in such instances, may be packed with additional Smooth-On Corrugated Metal Gaskets (Sketch A, next page) coated with Smooth-On No. 3, or if the faces remain very far apart, a filling of Smooth-On No. 1, as shown in B, is preferable to forcing and straining the pipe. A central ring sawed from a piece of pipe is inserted as shown and it serves with the flange



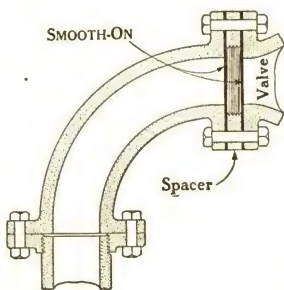
(A) Flanges that will not come together, made into a tight joint by using a number of gaskets coated with Smooth-On No. 3



(B) Method of making tight flanged joint where flanges are too far apart to permit utilizing Method A

faces to form a caulking space. After the bolts are drawn tight, Smooth-On No. 1 in the form of a stiff putty is packed tightly into this space between the flanges. The bolts should be tightened again after the Smooth-On has set. The expanding action of Smooth-On in hardening will make the joint tight.

An alternate arrangement (C) consists of a spacer made to the right thickness by facing off a flange of the same size and placing this spacer and gaskets coated with Smooth-On No. 3 between the two flanges. This scheme was utilized in substituting a long-sweep elbow for a 6-in. standard elbow and short nipple on the stop valve of a 150-hp. boiler. In assembling, the valve and long sweep elbow flanges would not come together by $1\frac{1}{16}$ in. The joint made with the spacer and Smooth-On was still tight after six years' service.

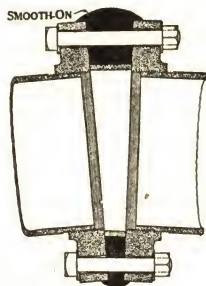
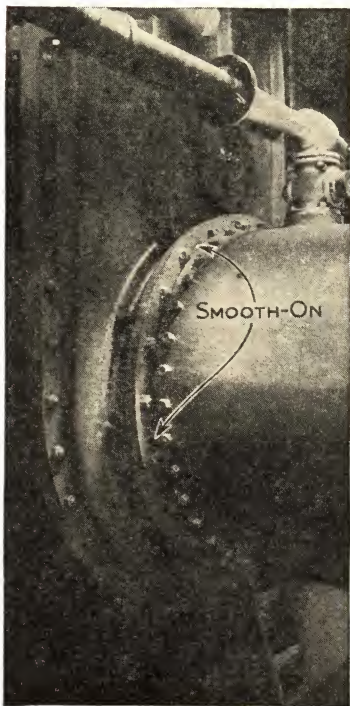


(C) Tight joint made by facing off an old flange and using as a spacer between Smooth-On gaskets

Flanges that are out of alignment:—This repair is shown on Page 35. A central ring to form the caulking space between the flange faces is cut at the proper angle to fit the opening as shown. The bolts are inserted

and drawn up. After which the space between the flange faces is filled with Smooth-On No. 1.

This procedure was utilized in an electric power plant in Astoria, N. Y. (see picture) to connect a new centrifugal pump to an old 18-in. pipe. This pipe and flange had previously been set out of level and in a concrete floor, when shifting into alignment would have necessitated tearing out much concrete. The pipe and pump flanges did not square up by $2\frac{1}{2}$ in. After 14 years of steady service, this joint was still tight—a result that would be almost impossible without Smooth-On.



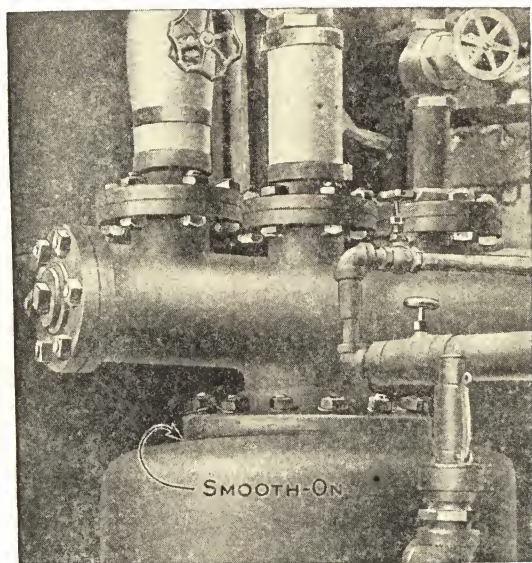
Method of making a tight joint where alignment is impossible



Alignment impossible by $2\frac{1}{2}$ inches at one edge, but Smooth-On made a perfect lastingly tight joint

On setting a pump, the flanges connecting the gate valve on the delivery, as shown at the left, were $2\frac{1}{2}$ in. out of line. To make the joint, the pump flange was cut off and a wrought-iron plate, flanged and shaped to fit the interior of the main was bolted to it so that the flange fitted to the one on the gate valve. Both the flange joint and one between outlet and inserted flange sleeve were made tight with Smooth-On No. 1

Sleeve and flanged joint where centers are out of line:—In cases where centers of large mains are out of line, it is sometimes practical to cut off one of the flanges, replace it with another formed from sheet metal, drill holes in the new one to match the old, and make Smooth-On joints both between the flanges and between the new flange and its bolted connection to the line. A typical joint made this way on a 45-in. pump outlet in the Brooklyn Navy Yard (see Page 35) gave entirely satisfactory service for over 10 years.



Leaky flange on boiler dome made tight:—

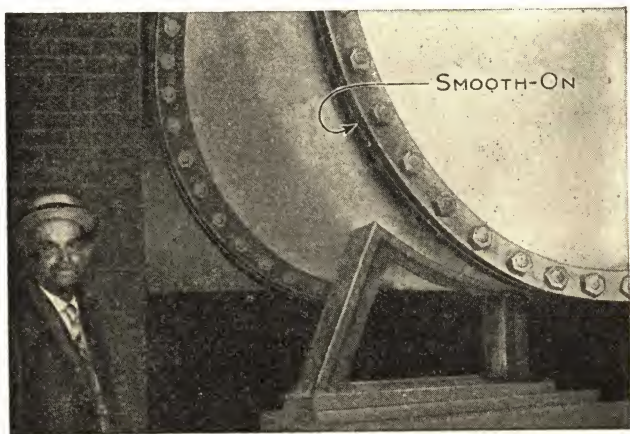
The flange on this boiler dome at a plant in Jersey City, N. J., leaked badly. To take the header off and make an ordinary joint would have cost from \$12.00 to \$15.00. Instead, part of the old joint was picked out all around and replaced with Smooth-On No. 1.

The whole job took less than two hours

Restoring pressure tightness at flanged joints without gasket renewal or disassembling:—Disassembling and gasket renewal, especially on large joints, should be a last resort because of the hard work, the annoyance of long shut-down, the possibility of failure to restore perfect alignment, and the cost of labor and new material.

In the simpler cases, part of the old packing or gasket may be picked out at the flange edges with a packing hook, and Smooth-On No. 1 caulked into the opening.

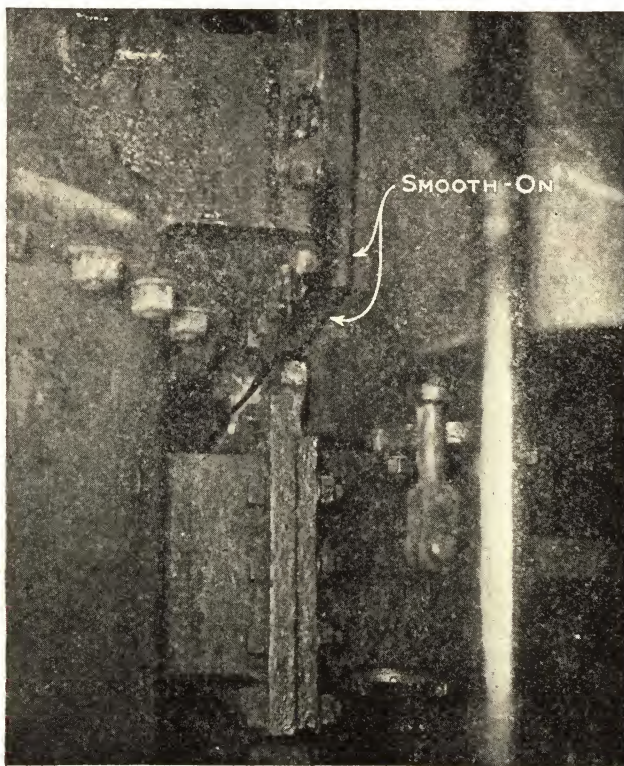
Where the leaky joint happens to be on a pressure container in which a partial vacuum can be secured either by connecting with an air pump, or by filling with steam, shutting valves and causing condensation, Smooth-On No. 3 may be painted onto the leak with a brush, and will be drawn in by the vacuum.



Heater-receiver joint made tight

A permanent repair was made in this way on the heating receiver (see picture) of a 32-in. x 70-in. x 72-in. cross-compound engine at a plant in Fall River, Mass. The cast-iron shell of this receiver is made in two transverse sections. The packing between the two shell sections gave out. The engine was shut down and the air pump kept running to produce a vacuum within the receiver. Smooth-On No. 3 was applied at the joint with a brush while the receiver was still hot, and was drawn into the joint by the vacuum. The leak stopped at once.

The saving of heavy expense for labor and the avoidance of more expensive shut-down as effected by Smooth-On was again illustrated in the following instance: the steam-chest nozzle in the engine of one of the busiest main-line ferry boats entering New York City leaked to such an extent that disassembling of the entire front of the engine and removal of the steam chest was under

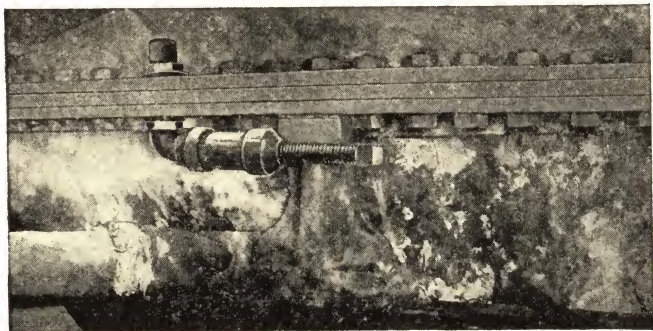


Steam-chest nozzle repaired by Smooth-On and tie-up of a ferry boat avoided

consideration. Perfect tightness was secured by applying Smooth-On No. 1 as shown in the picture.

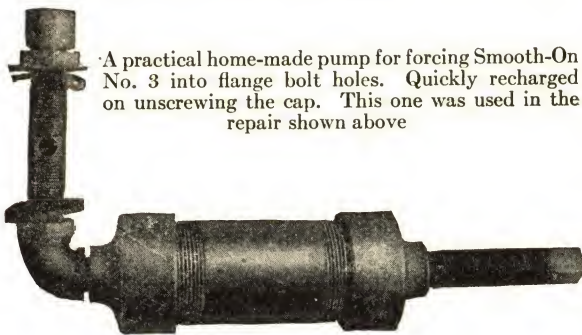
Another method, perhaps best of all for stopping leaks at large gasketed joints, is to remove the bolts or studs nearest the leak and force Smooth-On No. 3 into the gasket space surrounding the bolt. The bolts nearest the leak are taken out one at a time. As soon as the most possible Smooth-On is forced into a hole, the bolt is replaced, and the process repeated at the next until all leaks are stopped.

Pressure should be turned off while a bolt is being taken out or replaced, but left on at other times to press against the Smooth-On and keep it from being forced



18-ft. flanged joint made tight and \$500.00 saved:—
This leaky flanged joint on a copper kettle 20-ft. high by 18-ft. diameter was made tight by forcing Smooth-On No. 3 into the bolt holes as described in the text. The pump is shown inserted into the bolt holes. To take this kettle apart and put in a new flange would have cost \$500.00

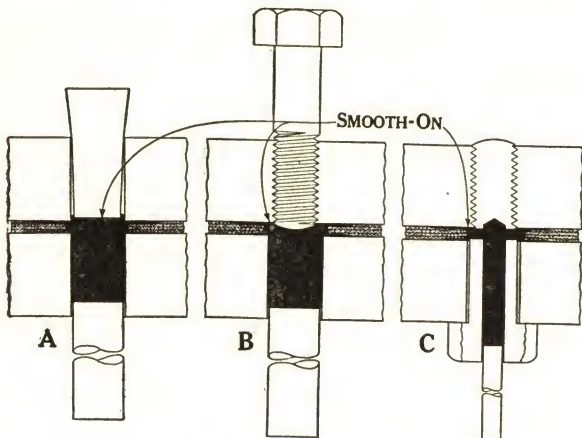
completely through the flange. If the pressure happens to be steam, the heat drives the volatile matter out of the Smooth-On and makes it set quicker.



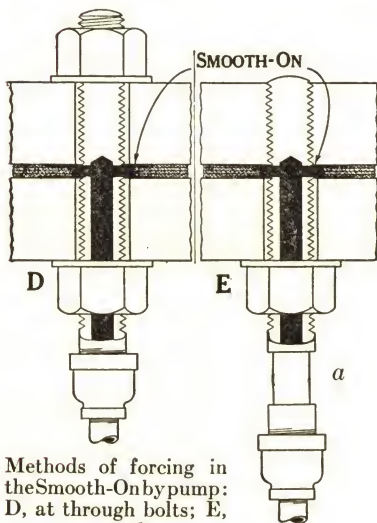
A practical home-made pump for forcing Smooth-On No. 3 into flange bolt holes. Quickly recharged on unscrewing the cap. This one was used in the repair shown above

The Smooth-On may be forced into place either with a rod and hammer (Sketches A, B and C, Page 40) or with a screw force pump (D and E).

With the former method, the hole into which the rod is placed, is repeatedly filled until sufficient Smooth-On has been inserted. When this method is being applied at through bolts, either a tapered wooden plug, held under clamps if necessary, or two nuts with washers similar to D, may be used to blank off one of the holes.



Methods of forcing Smooth-On No. 8 through bolt holes and into flange joints by hand: A, at through bolts; B and C, at studs

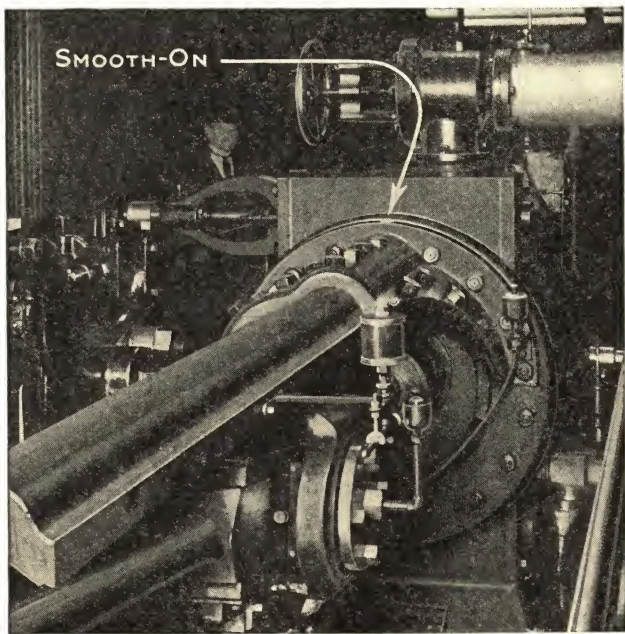


Methods of forcing in the Smooth-On by pump: D, at through bolts; E, at studs

In the case of studs, the stud may be temporarily reversed (B) to blank off the hole and protect the threads, or one of the studs may be made into a tool by drilling and using as in C.

In plants where there are apt to be many gasket leaks at large bolts it will be worth while to keep a screw-force pump as standard equipment and make special tools as shown in D and E. The pumps used in forced lubrication of automobile springs are excellent for the purpose, or one may be made from capped brass tubing. The tool shown in E should be provided with a square wrench hold (a) to facilitate installation and removal. Connection with the pump is easily effected with reducers or drilled cap.

Instead of bolt removal by the above methods, it is sometimes practical to drill a small hole for insertion of Smooth-On, where leakage is confined to small area.

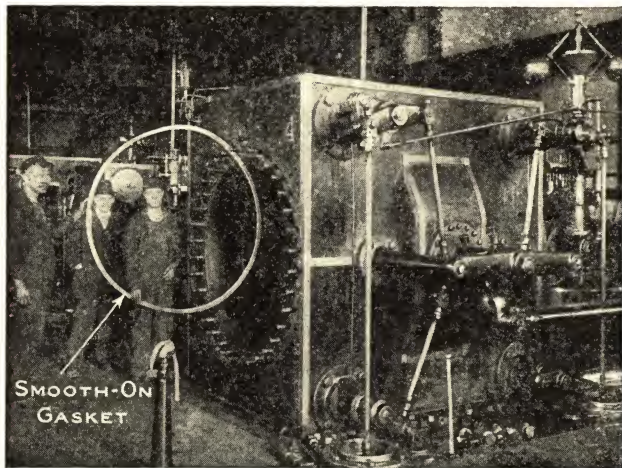


Smooth-On No. 3 saved the cost of taking down this engine when the mill was too busy to permit the shutdown that would have been necessary to put in a new gasket. See page 42

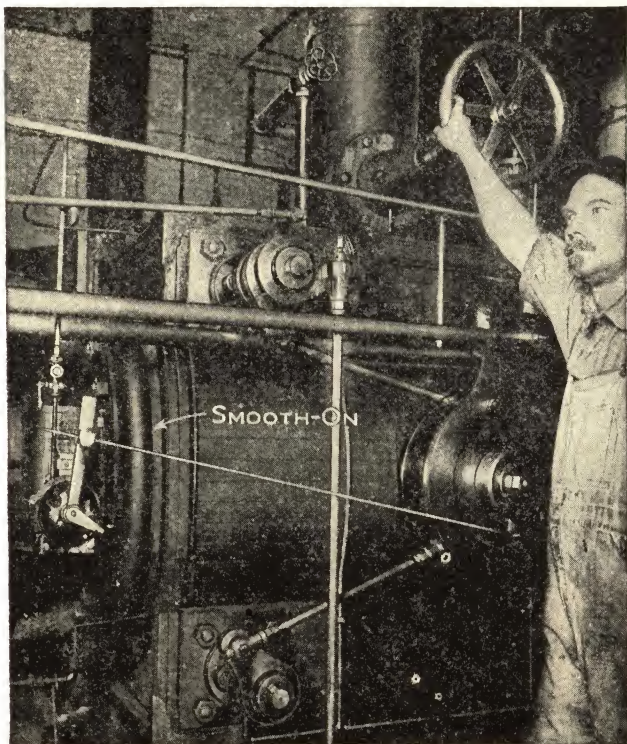
This was done in Brooklyn, N. Y. as an emergency repair on a 28-in. x 60-in. Corliss engine, of which the cylinder head began to leak badly. After shut-down, the Engineer drilled a $\frac{5}{8}$ -in. hole in the top of the girder from where it is recessed to receive the cylinder head, (See picture, Page 41) and by repeatedly filling with Smooth-On No. 3 and forcing in with a $\frac{5}{8}$ -in. rod, about 4 lb. of Smooth-On was worked into the opening which caused the leak. After letting the Smooth-On harden until Monday morning, the engine was started and found absolutely tight. A year afterward it had remained so.

Cylinder-head joints:—Smooth-On Corrugated Iron Gaskets coated with Smooth-On No. 3 are just as effective here as on flanged line joints, as will be seen from the captions of the pictures on this page and on Pages 12 and 43.

In another instance, an Engineer at Cleveland, Ohio, had to install a worn duplex pump that had been shipped in from one of his employer's other plants. This pump,



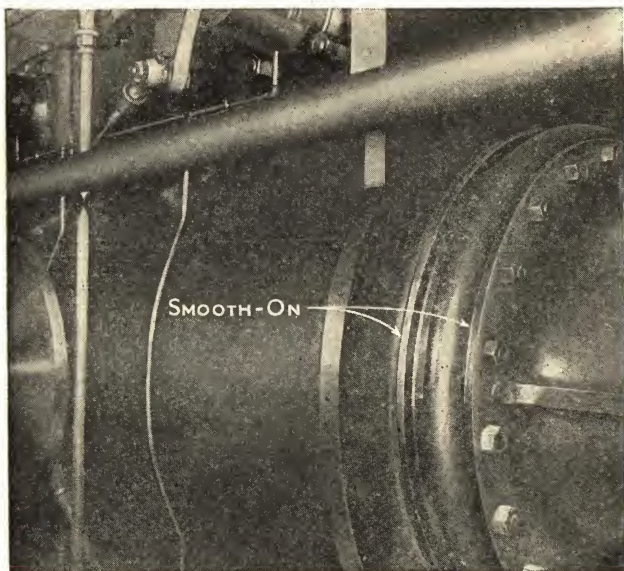
Big gasket—perfectly tight:—This 54-in. by 57-in. one-piece Smooth-On Gasket is installed on a steam engine cylinder in one of the largest power houses in New Jersey. The Chief Engineer of the plant wrote: "*Before using Smooth-On Gaskets, I had much trouble with cylinder-head joints. Some of my Smooth-On Gaskets have now carried 160-lb. pressure for over a year, and all give perfect satisfaction.*"



Copper gaskets and sheet-packing gaskets would stay tight for only a very short time on this high-pressure steam cylinder head of a 27-in. by 36-in. by 50-in. cross-compound refrigerating machine. A Smooth-On Corrugated Iron Gasket coated with Smooth-On No. 3 was applied. Our last advice, 17 months later, was that the joint had remained entirely tight

which was handling water at 125-lb. pressure and 212 deg. temperature, failed twice in succession at the same place in the joint between the water cylinder and cradle, different kinds of packing having been used each time.

"We had a particularly hard cylinder-head joint to hold, and after trying a number of different packings for this joint, among which was corrugated copper, all of which failed to hold for any great length of time, we decided to try your corrugated Smooth-On Gaskets on this joint, which we did, and the present one has now been in use about one year, carrying 160 lb. pressure, and has given us no further trouble."—This refers to the engine shown on Page 63.



Faces not parallel, but Smooth-On made the joint perfect and avoided rebuilding the foundation. See text

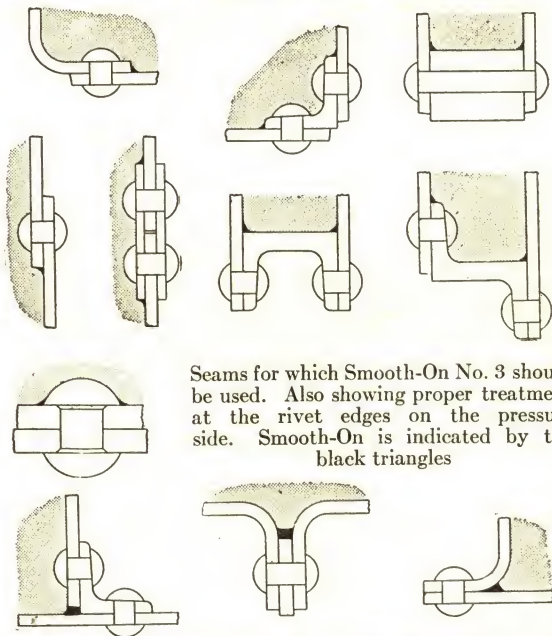
This joint was taken down for the third time, and on the next gasket, the surfaces were coated liberally with Smooth-On No. 3, paying particular attention to the bad spot. The pump was left standing three days after reassembling and then started. Three months later it appeared that this joint would stay tight for the life of the pump.

Occasionally slight misalignment develops between two large gasketed faces, as in the case shown on this page. The 36-in. steam cylinder had been removed from its girder because of a faulty foundation. When reassembled on a new foundation, the cylinder and girder faces would not come parallel.

A thick putty consisting of three parts of Smooth-On No. 3 with one part Smooth-On No. 1 was troweled $\frac{1}{16}$ in. thick onto the joint. The cylinder was then bolted onto the girder carefully and on starting the machine, the joint was warmed up gradually. The joint was then found to be perfectly tight.

Preventing or stopping leakage at riveted seams

SMOOTH-ON is much used for repairing leaky seams and rivets. Prominent boiler and tank builders prefer it for new work because it makes joints that stay tight in places where caulking is not successful.



Seams for which Smooth-On No. 3 should be used. Also showing proper treatment at the rivet edges on the pressure side. Smooth-On is indicated by the black triangles

Seams for which Smooth-On No. 1 or No. 2 should be used

For joints as shown above, Smooth-On No. 3 should be applied with a stiff brush or trowel. For joints where expansion of the Smooth-On mass can be utilized in adding to tightness, Smooth-On No. 1 or Smooth-On No. 2 should be used.

The Smooth-On should be put into joints of the types shown to form a liberal fillet, and preferably *on the pressure side*, as when pressure is applied, the Smooth-On is pushed well into the seam and all leakage is stopped.

Application of the Smooth-On to the *outside* is also practical where the Smooth-On may be forced into the seam or drawn in by partial internal vacuum.

Repairing leaky tanks:—Leaks in seams of plate or sheet metal tanks can be made thoroughly tight as described on Page 45 by using Smooth-On, and as no heat is required, the use of Smooth-On is entirely safe on tanks holding gasoline, oil or other inflammable fluids.

A 4-ft. x 20-ft. x 30-ft. tank made from $\frac{1}{4}$ -in. steel plate, at Chattanooga, Tenn., was lengthened to 60 ft. and leaked until it wet all the insulation. Caulking did not stop the leak. The seams and rivet heads were cleaned and three coats of Smooth-On No. 1 were painted onto the seams. Each coat was allowed to dry and harden before applying the next. Four years later, this tank was still tight and giving excellent service.



Smooth-On stopped the leaks where caulking failed:—This iron tank, stood on end to show interior and comparative size, is used for holding lubricating oils. After caulking had failed to stop leaks at the seams and rivets, Smooth-On No. 1 was forced into the openings and allowed to harden. Over a year afterward the tank was still perfectly tight

Stopping leakage in steam boilers

LEAKAGE in steam boilers should be stopped promptly and effectively, and the repair should be made at the earliest practical moment.

Methods or devices which interfere with circulation, heat transfer or free steam generation and release should be avoided. In connection with the latter, the manual of a prominent boiler insurance company takes particular exception to oatmeal, potatoes and various floating non-metallic preparations that are put into a boiler to stop leakage at points below the water line. These substances act merely by temporarily plugging up the small openings through which the water escapes. Aside from at least partially failing to accomplish their purpose, such materials are condemned for other very good reasons. Some adhere to and insulate the metal against heat transfer or form acids which promote corrosion. Others increase foaming, priming and objectionable scale and sludge.

Smooth-On Cements are particularly adapted to boiler requirements because they set and stay exactly where placed, and once set have the same expansion coefficients as the solid metal.

Stopping leaks at seams and riveted joints:—The proper application of Smooth-On to seams and riveted joints is explained in a general way on Page 45. Variation of these methods for particular locations is further indicated in the following few references to typical repair jobs.

A 60-in. x 16 ft. h.r.t. boiler with front flue sheet flanged outwardly, making a dry joint, started to leak between flue sheet and shell, at a place under a manhole plate. The rivet heads in the girth seams and the shell at the edge of the flange on the flue sheet were badly corroded. On the advice of an inspector, the joint at this location was cold-riveted by a boilermaker and the seam caulked. This stood a 135-lb. cold water test, but began leaking again after 10 days service. On a Sunday afternoon after the boiler had cooled down, Smooth-On No. 1 was worked into the joint from the inside of the boiler and caulked in with a hardwood wedge. Sunday night the boiler was filled up again and went to work without sign of leakage. This repair gave the owners three years more good service at a time when the expense for a new boiler could not be considered.

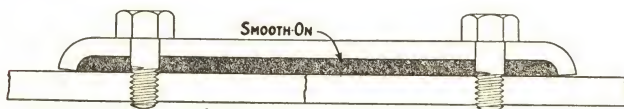
A 66-in. x 16-ft. h.r.t. boiler carrying 110-lb. pressure sprung a leak along the bottom of the front head seam. The scale was removed from the inside, the metal cleaned and Smooth-On No. 3 as a paste was applied along the seam. No more leakage developed during the next four years, after which this boiler was taken out of service.

A threshing machine boiler that was operating at from 120 to 160-lb. pressure leaked from a number of small holes along the rivet seam on both sides of the fire box. The seam was filled with Smooth-On No. 1 from the inside as shown in the sketch, the handhole plates put back, water put in, and the boiler was started after 12 hours. Leakage had stopped entirely, and after four years more service of 14 to 16 hr. per day for about six months each year, the boiler was still in excellent condition.



Fire-box seams filled with Smooth-On No. 1 to stop leakage

Making patches on boiler shells:—Patches on the shells of h.r.t. boilers and on the drums of water-tube boilers are of two types: *soft* (usually regarded as temporary) in which the patch plate is held by bolts or studs, and *hard*, in which the plate is permanently riveted into place. Either should stop the leak and add strength to the weakened part.



Soft patch filled with Smooth-On

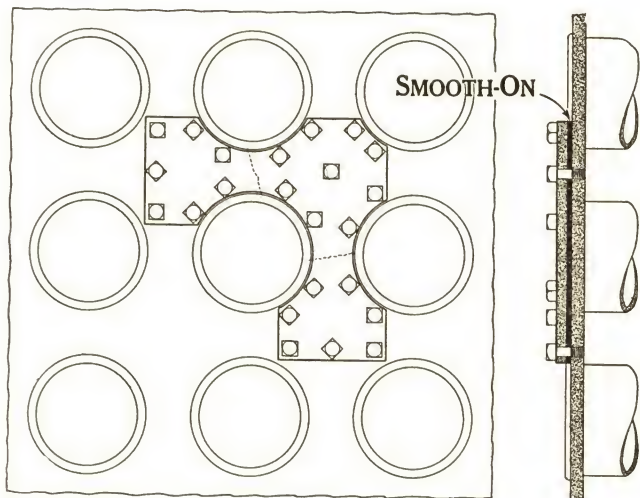
Soft patch made with Smooth-On:—The patch plate holds the Smooth-On in place, and should therefore be made large enough to cover all the leak, crack or weakened part. The plate, not necessarily as thick as the boiler plate, should be conformed to the surface to be repaired and lipped down to hold the layer of Smooth-On which should be composed of equal parts by volume of Smooth-On No. 1 and No. 3 mixed to a stiff putty.

The patch plate should be secured with tap bolts or through bolts, as small as consistent with the patch.

If the patch is in the fire, tap bolts with squared and

tapered heads should be used and the square part of the heads cut off after complete assembly.

The boiler may be put into service as soon as the patch is finished.



Smooth-On used under a patch plate to stop leaks at flue sheet cracks

Repairing cracked flue sheets:—Cracks in a boiler tube or flue sheet usually extend from tube to tube, and may be covered by a patch plate as shown, extending over the crack and covering enough good metal to obtain a secure hold.

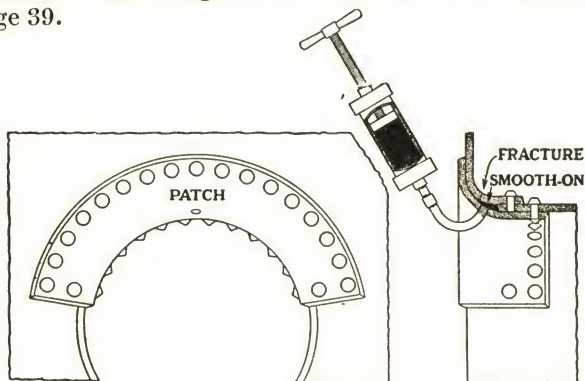
Before bolting the patch plate to place, the crack and the contact surfaces of both patch plate and flue sheet should be coated with Smooth-On No. 3.

General instructions for applying a patch are given on Page 61.

Hard patch:—The plate of a hard patch, being riveted, makes a supposedly tight contact, but to prevent pressure working its way through the fracture and possibly through the riveted seams, the voids between the boiler metal and the patch plate should be filled with Smooth-On No. 3.

The diagram on the next page shows how a pump was used on one of the U. S. transport ships to force Smooth-On No. 3 under a patch plate riveted to the boiler plate. Patches that have started to leak can be made tight by this method.

Details concerning the force pump will be found on Page 39.



Packing a hard patch with Smooth-On No. 3

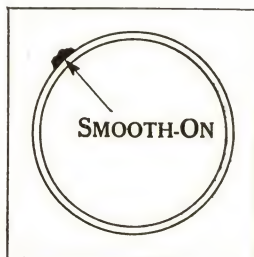
Stopping leaks in cracked and weakened header sections of water-tube boilers:—Headers in water-tube boilers occasionally crack or weaken and warp from heavy rolling of tubes where there is no particular danger, but the resulting leakage becomes a nuisance.

Where the break is not serious the crack may be cleaned out and filled with Smooth-On No. 1 from inside and outside.

A case of this kind where the repaired header ceased to leak and held perfectly for months, before a new header could be put in, was reported from Rockford, Ill.

In another instance, a crack $1\frac{1}{2}$ in. long at the tube hole in the header of a 604-hp. boiler required either taking out a tube and waiting until next morning for a welder, or making a quick Smooth-On repair. The boiler was drained, the inside of the header cleaned out, and Smooth-On was put into and over the crack and left one hour to metallize. A year later this repair was still there and perfectly tight.

In cutting out old tubes in a water-tube boiler with cast sectional headers, workmen accidentally chipped a piece out of a header, leaving an opening too



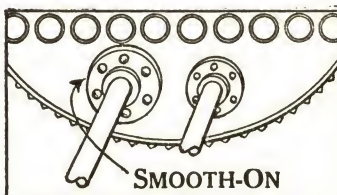
Tube hole with piece chipped out. A filling of Smooth-On restored the seat

large to roll a tube against. The void was filled with Smooth-On and when this had metallized, the repair was smoothed down with emery cloth. The new tube rolled in at this location had not leaked a drop after five years.

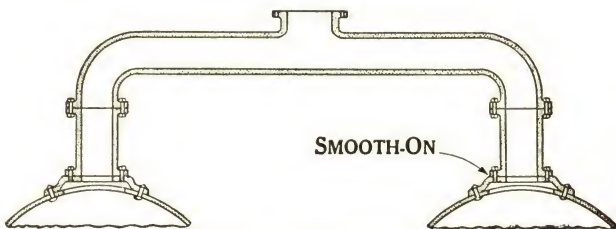
Restoring pitted or steam-cut flange faces:—Perfect new seat faces for the gaskets can be made by cleaning and scraping out the depressions, building them up with a soft putty of Smooth-On No. 1, and filing and dressing the surface true with emery cloth, after the Smooth-On has hardened.

Rust had so eaten into a blow-off connection (see sketch) in an old boiler at Brooklyn, N. Y. that the old flange had to be replaced by a larger one, with holes located in a different position. Smooth-On No. 1 applied to the damaged surface produced a perfect seat.

Four years later this repair was still as tight as was the original joint when first made.



Corroded blow-off connection restored perfectly by Smooth-On No. 1



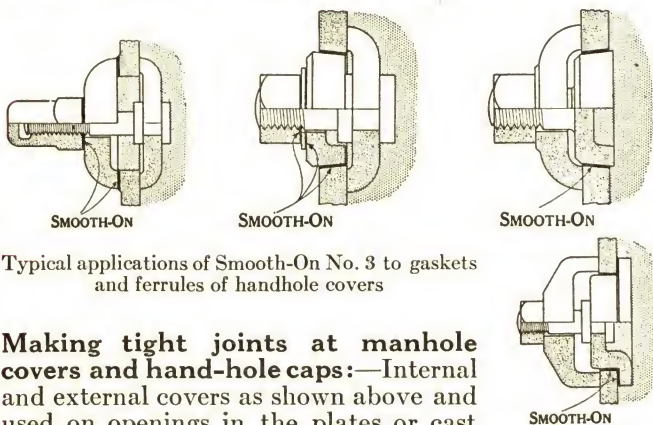
Yoke connection made tight with Smooth-On No. 1

Increasing pressure to 195 lb. on a double-drum water-tube boiler at South Barre, Mass., caused a pin-hole leak to develop (see sketch) where the 6-in. yoke was connected to one of the drums. The leak became worse and was followed by smaller similar leaks extending for 2 in. around the joint. Vibration caused these leaks to start and stop intermittently, and it seemed necessary to break both yoke connections, take down a long run of piping and insert a new yoke. Instead, Smooth-On No. 1 was applied to the leaks and allowed to harden. When the man who had made this repair in 1912 returned in

1920 from service overseas, the Smooth-On repair was still tight.

Securing tightness at tapped openings in the boiler shell:—The threads of the entering pipe should be well coated with Smooth-On No. 3 or if worn or battered, with a paste of Smooth-On No. 1.

Tapped openings for the installation of water columns must be very accurate or the cocks do not align well enough to prevent frequent breakage of the gauge glass. Trouble of this kind compelled a plant in Brantford, Ont., to put in three successive connecting pipes, all of which leaked. In doing so, the threads became badly worn, so the Engineer cleaned them and put the joint together with Smooth-On No. 1. Two years afterward this joint was still in service under 110-lb. boiler pressure without ever having shed a tear.



Typical applications of Smooth-On No. 3 to gaskets and ferrules of handhole covers

Making tight joints at manhole covers and hand-hole caps:—Internal and external covers as shown above and used on openings in the plates or cast headers of boilers, economizers, superheaters, closed heaters, oil stills, pressure tanks, etc. can be made tight by coating the gaskets or ferrules with Smooth-On No. 3 immediately before assembling.

The insides of manholes and handholes are often hard to get at for scraping off the faces. Coating the gaskets on both sides with Smooth-On No. 3 in placing the covers will not only keep the joint tight, but when next overhauling time comes, the old gaskets will come out easier.

A battery of 450-hp. boilers at Tupelo (Miss.) carries 200-lb. pressure and 80 deg. superheat. These boilers gave continuous trouble from burning of the gaskets and

leakage at the manholes and handholes until after the gaskets were coated with Smooth-On No. 3, when the leakage disappeared.

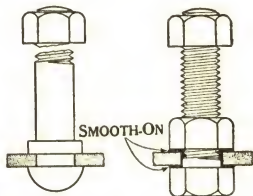
If the leakage is caused by pitting, corrosion or steam-cut passages on the gasket faces, the surface should be built back to normal by filling all depressions with Smooth-On No. 1, and filing and rubbing with emery cloth after the Smooth-On has hardened.

A bad pit on a seat where the handhole plate sets against the header, caused much trouble on one of the water-tube boilers at a hospital in Wheeling, W. Va. The gasket would blow out, and the boiler would have to be cut out regularly to put in a new one. The hole, big enough to put a thumb in, was filled with Smooth-On No. 1 which was held in place over night and shaped by a board against the header. This stopped the leakage.

A 250-hp. boiler carrying 125 lb. pressure at Woodlawn, Pa. started to leak at a cap on the mud drum. Owning to cold weather, repair was postponed until on finally taking off the cap, steam was found to have cut two egg-shaped holes in the mud-drum gasket face. No gasket could be made to hold, nor did a plate which was put on the outside. The holes were finally filled with Smooth-On, a red rubber gasket put between the plate and cap, and after six months service, the repair was still tight.

Repairing a broken or leaky stud on a handhole or manhole plate:

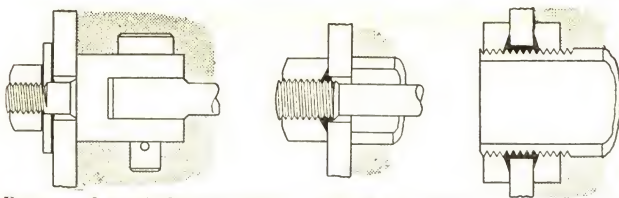
—In an emergency when no other properly formed stud is available, the old one may be drilled out and replaced as shown in the picture, by a bolt which is threaded all the way down. The under side of the bolt head and the nut are liberally coated with Smooth-On No. 1 and the nut drawn tight.



Broken stud and a good emergency replacement

The Engineer at the plant of a Cleveland newspaper used this scheme for a quick repair on a boiler carrying 90-lb. pressure. A previous attempt using the bolt and nut as shown, but heated and peened instead of filled with Smooth-On, had failed.

Making tight connections at the ends of screw staybolts and mainstay braces:—A stiff putty made

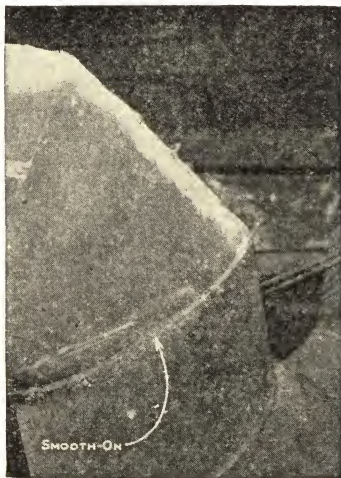


Brace and staybolt connections. Black spots indicate Smooth-On from Smooth-On Nos. 1 and 3 is excellent for making and keeping these joints tight, especially where the nuts are hollowed out underneath to receive the Smooth-On.

End-to-end braces put into a h.r.t. boiler with ground lock nuts, at Carey, O., leaked even with lead gaskets. A boiler inspector said the repair was a boilermaker's job, but the Engineer merely put Smooth-On No. 1 under the nuts and the result was entirely satisfactory.

Stopping leaks in breeching:—Smooth-On No. 1 makes an ideal repair and tight joint at any location subjected to extreme heat, as the Smooth-On when metallized, is not impaired even by direct exposure to flame. Further, as metallized Smooth-On expands and contracts in the same degree as the surrounding metal, the joint will stay tight where nothing else could be kept from cracking under excessive expansion and contraction.

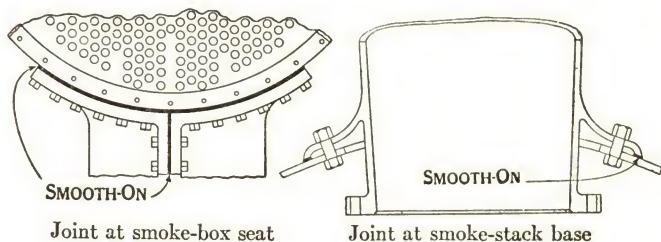
The illustration shows how a Chicago manufacturer stops leaks in the breeching of power boilers. In this plant, dampers in the breeching are replaced by two U-bends on each boiler—one leading to the stack and the other to a fan which draws gases from the boiler and delivers them for process work. Dilution of the gases is not permissible, so the Chief Engineer uses Smooth-On No. 1 at the cracks to shut out all air except that which passes through the fire. Leaks at any other place should never be permitted.



Boiler breeching made tight

Uses for Smooth-On in locomotive construction and repairs

RAILROAD shops use Smooth-On No. 1 and Smooth-On No. 3 for making boiler repairs under patch plates, stopping leaks and corrosion in boiler legs and tender tanks, and making screw-thread joints. Such applications are the same as in stationary boilers and engine practice. (See General Index, Page 133).



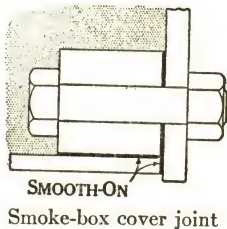
Smooth-On is also used in these special applications:

Between smoke-stack base and smoke-box shell

Between smoke-box shell and smoke-box seat

Between the front edge of the smoke box and cover

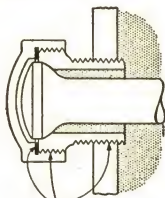
Between cylinder saddles (vertical).



A Smooth-On filling at bearing points gives a uniform strong close contact, with corresponding good pressure distribution, and at points subjected to smoke-box temperatures, the Smooth-On remains strong and tight because impervious to heat.

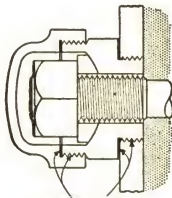
Flexible stay-bolt and mainstay terminals:—Maintaining steam tightness at points where stays or flexible staybolt sleeves are screwed into the boiler shell, especially where the sleeve must be inserted at an angle with the outer sheet, will involve no difficulties if Smooth-On No. 3 is used. Gaskets, threads on the caps, and threads on the far terminal should be coated with Smooth-On No. 3 only. This procedure will usually avoid all the leakage nuisance where the threads were not made accurately in the first place, or where a sleeve was not

carefully applied in the past and the threads have been impaired.



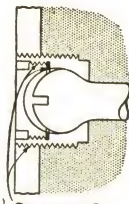
SMOOTH-ON

Mainstay head
with exterior cap



SMOOTH-ON

Staybolt with ex-
terior cap



SMOOTH-ON

Staybolt with
countersunk
connection

Repairing leaks in cast-iron (low-pressure) house-heating boilers

HUNDREDS of heating boilers are discarded every year and thousands of high repair bills are contracted where intelligent use of Smooth-On would assure long continued satisfactory service at very low cost.

Leaky joints and cracks can be made tight by forcing in Smooth-On No. 1 (Page 59) and if necessary covering with a light strap or plate (Pages 60 and 61). Porous spots may be treated as described on Page 78, otherwise Smooth-On applied under a plate will stop the leakage.

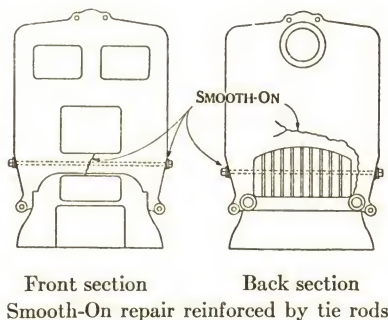
What may be accomplished with even the simplest type of Smooth-On repair is evident from the following comment on application in Bay City, Mich. *"The cast iron boiler used under 10-lb. steam pressure froze and burst, with two large cracks visible. The boiler was thought to be beyond repair—which meant a new one at a cost of from \$700 to \$900.*

"We filled both cracks with Smooth-On and fired up. The boiler has since seen three winters' service and appears to be good as ever.

"We saved \$800. Nobody knew what we did or how. Several interested parties used cold chisels on the job to find out, but the Smooth-On had so united with the other metal that it stood filing and chipping and looked fine."

Tie rods may be employed to hold the broken edges together firmly and reinforce the Smooth-On repair, where the sections can be drilled at suitable locations for insertion of the rods. This method, as shown by the diagrams, was employed at one of the pumping stations

of a pipe line company, where the 10-section heating boiler had ruptured in both front and back sections during a cold spell.



The front section broke between the fire and clinker doors and sprang $\frac{1}{2}$ in. out of line. The rear section opened at a crack 26 in. long and at the worst location, nearly $\frac{1}{4}$ in. wide.

Rather than wait three weeks in cold weather to get new sections from the builders, a quick repair was decided upon. Holes were drilled through the sections for the rods. Smooth-On No. 1 was pounded into the cracks, which were then drawn tight by means of the tie rods, and the sections put back in place. The next morning, when the boiler was fired, the repairs held, and after two more heating seasons, they were still in first class condition.

In making this kind of a repair, Smooth-On No. 1 should also be used at the holes for the tie rods, both to make the holes pressure tight and to provide a firmer seat for the washers and nuts.

"I have quite a number of house-heating boilers to inspect and clean out. In replacing the man and handhole covers, I always cover both sides of the gasket with Smooth-On No. 3, so when you get ready for the next season, you do not leave part of a gasket stuck on the inside of boiler plate, which on some boilers is very hard to get at to scrape off the face. When you use No. 3 you have no trouble whatever. You can pull the old gasket out and put a new one in, and make all connections easily. I have not found anything up to date that can take the place of Smooth-On No. 3, no matter what the store keepers tell you. They only sell—I use and watch results, and know what I want."—ALEX BERRY, 1102 University Ave., New York.

Making tight oil-burner joints:—Oil is ordinarily hard to hold, but if the joints are laid up with Smooth-On No.

3 there will be no leakage. Manufacturers of oil-burning equipment are adopting Smooth-On No. 3 for making all screw-thread joints on oil lines because joints so made are dependable.

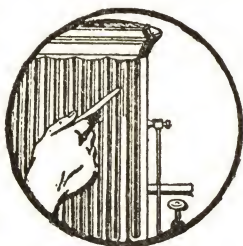
Stopping leaks in steam or hot-water radiators

A CRACKED radiator section may be repaired by forcing in Smooth-On No. 1 as directed on Page 59.

Leaks in slip or screwed joints connecting sections should be repaired as follows: If the leak can be reached, Smooth-On No. 1 is applied to the crack as a stiff putty, and forced in well as directed on Page 59.

If the leak cannot be reached, a tin or metal band is cut to fit between the sections and around the joint. The band is applied as shown in the diagram, and the space between the band and the joint filled all the way around with a soft putty of Smooth-On No. 1, after which the bolt is inserted and drawn tight. This will force the Smooth-On into the leak and seal it all the way around.

By first spreading the Smooth-On around the joint, friction or insulating tape may be substituted for the metal band.



Repairing a cracked section with Smooth-On



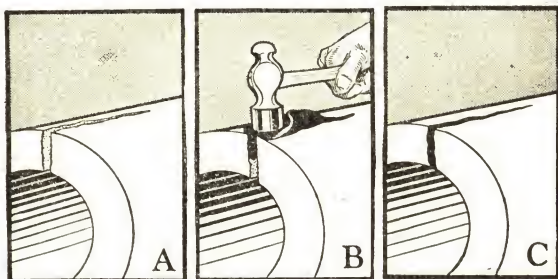
Repairing leak at joint between sections

"An idle hot-water radiator in my home froze, and one section sprung an 11-in. crack and leaked profusely. After draining, the cracked surface was scraped, sand-papered and filled with Smooth-On No. 1. This radiator has since been frozen twice under similar conditions. Not a sign of a leak developed. Smooth-On saved the cost of a new radiator and installation (about \$50.00) and the delay while waiting for a new one of correct size and style."—KNOWLES SMITH, Dean, Dept. of Engineering, Notre Dame University, South Bend, Ind.

Making cracks in metal pressure-tight

CRACKS or openings of sufficient depth to hold Smooth-On No. 1 which is hammered, forced or caulked in, utilize the expanding action of Smooth-On in hardening, to improve the tightness of the repair. Smooth-On No. 3 is applicable as a paint, on very fine cracks, and this may be supplemented with Smooth-On No. 1. Where Smooth-On No. 3 or a mixture of Nos. 1 and 3 is applied to a crack as a thin paste, partial vacuum within, from steam condensation with inlet and outlet valves closed, helps to draw the Smooth-On into crack.

The simplest, quickest way to repair breaks, fine or coarse cracks, etc., where the Smooth-On can be applied directly into the crack, is that shown below.

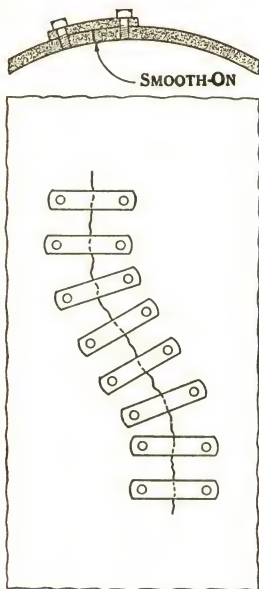


The simplest and quickest way of applying Smooth-On No. 1 to stop leaks at cracks. See text

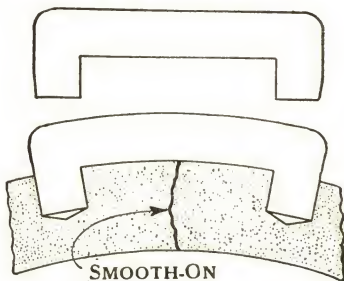
All fluid and pressure should be removed from the metal, grease and dirt cleaned away (A) and a sharp-pointed tool run along the edges to slightly open the crack so that the Smooth-On can enter. Smooth-On No. 1 mixed to a soft putty should be applied over the crack and tamped in with a hammer (B), working all along the crack. The Smooth-On which spreads away should be brought back over the crack and the tamping continued with light blows until the crack is deeply filled. The excess of Smooth-On should then be removed from the surface (C) and the filling allowed to set until the Smooth-On becomes hard like iron, after which the repair is ready for service.

This method is equally applicable to any metal—steel, iron, brass, copper, lead and aluminum, and for low and moderate pressure service makes a permanent repair.

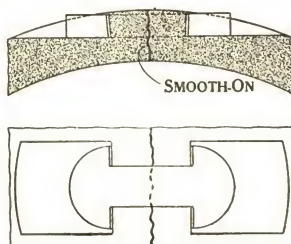
With thin (sheet) metal, it is desirable to build a little more Smooth-On onto the outside to act as a rivet.



Reinforcement of a long crack with metal straps to prevent opening up under pressure



(A) Smooth-On repair reinforced by staples



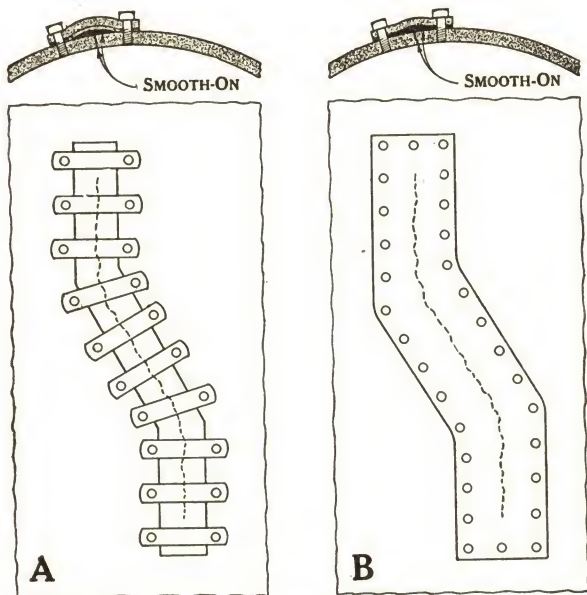
(B) Smooth-On repair reinforced by links

Straps, staples and links to prevent opening of cracks:—Tightness can be improved at large cracks by drawing up with clamps, fitting straps and studs as shown above, applying the Smooth-On No. 1 and then finally placing and tightening the straps.

A variation of this idea, which is practical in thick metal, substitutes staples (A) for the straps and studs. Holes are drilled at equal distances on each side of the crack, and after the latter is filled with Smooth-On No. 1, the staples are forced into the holes as shown in the diagram. The staple should be made a trifle short and its ends hammered into place while the staple is red hot. Expansion of Smooth-On in metalizing and contraction of the staple in cooling fills the crack very tightly.

Cracks in thick metal may also be held together by plate metal links (B) fitting into recesses chipped and

filed into the surface. The links should be made for snug fit *when cold* and heated red before being dropped into place. Pieces of hack saw blade or similar metal wedges forced between the hot lips and the solid metal will tighten the fit and draw the sides of the crack very close together as the links cool.



Smooth-On held by a patch plate, fastened (A) by straps and studs, or (B) by studs through holes in the plate itself

Patch plates:—Due to high pressure or inability to force enough Smooth-On between the surfaces of the fracture, the methods so far described may not be practical, in which case, the Smooth-On may be held under a metal strip (A) or patch plate (B). The plate or strip should be shaped to the outside contour, and the bolts on the plate should be placed near to the edge and should be as small and as close together as the thickness of the metal will permit. Additional bolts of larger size should be distributed over a plate of considerable area.

After forcing as much Smooth-On as possible into the crack, and applying more to the outside surface, the

plate with contact side similarly coated should be placed in position and the bolts drawn up.

Variations in repair methods for cracks in metal are described and shown on Pages 49, 50, 57, 63, 67, 69, 72, 74, 76, 80 to 82, 87 and 93.

Preventing extension at the ends of cracks:—Progressive extension of cracks in thick metal can usually be prevented by drilling and tapping holes at the ends of the cracks, and sealing with bolt ends or pipe plugs.

Smooth-On vs. Welding—Smooth-On is not urged as an unqualified improvement over welding under any and all conditions. Many repairs may be made by either method, and many by one, but not the other.

Welding has not yet reached the stage where it is always practical and dependable, as all metals do not lend themselves to proper bonding and all welding material is not uniformly efficient. The strength of the finished job is further dependent upon the skill of the welder, which is an uncertain quantity. Unfortunately also, a weld which looks perfect on the outside, but has little strength on the inside, does not show its weakness until put into service, which means a tedious repetition of the repair work in case of failure.

Making a welded repair usually requires specially trained men and bringing apparatus and material from a distance, which adds to delay and excessive expense for labor. More delay and more expense are involved sometimes in disassembling, always in preheating the abutting parts and usually in subsequent machining or finishing to overcome the distortion caused by the preheating.

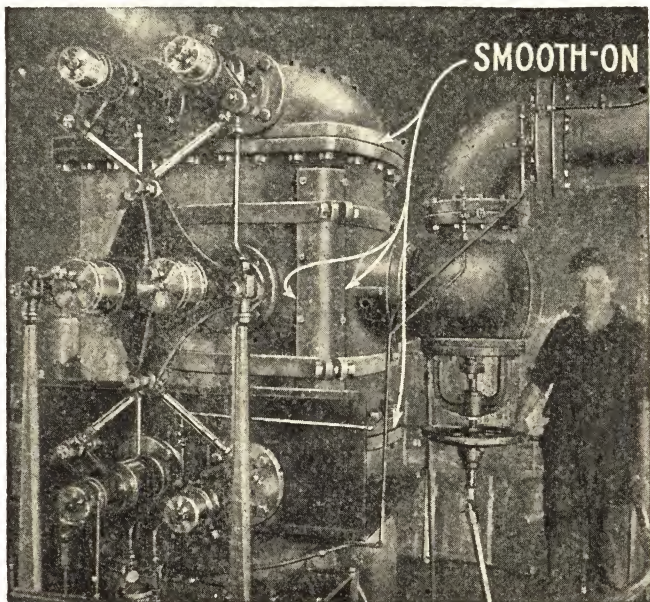
In contrast, Smooth-On costs almost nothing, always is or should be in the store room, requires only tools that are conveniently available, requires little or no preliminary preparation, can be applied by the engineer or his regular assistants, and is more uniform in results. No heat is required and there is no distortion. Another advantage is that Smooth-On can be shaped flush with a machined surface, and when hard can be finished with a file or emery cloth. The application generally requires no serious disassembling of cumbersome parts and the success is definitely determined and the repair ready for service in a few hours at most.

Numerous instances are cited throughout this book where Smooth-On not only made good after welding had failed, but where the cost of the successful Smooth-On re-

pair was a very very small fraction of the amount previously spent for welding. Inasmuch as a Smooth-On repair can usually be completed and ready for service before a welding job can even be started, Smooth-On should be considered *first*.

Repairing cracked and leaking cylinders, valve chests, casings, pressure shells, etc.:—The requirements of repairs of this type and the repairs themselves differ so widely that minute description of each would take more space than these pages afford. In general, repairs to cracks in pressure containers can all be made by one or a combination or slight variation of the methods described on Pages 59 to 61.

What Smooth-On will accomplish in connection with such cracks will be clearly evident on reading the following brief descriptions of actual repairs, which cover about every condition met in power plant practice.



Cost of a new steam chest saved:—A crack in the steam chest of this high-pressure engine cylinder was filled with Smooth-On No. 1, which was held to place by the bolted angle plate and straps shown. This patch made a permanent repair and has saved the cost of a new steam chest and reassembling

Cylinder head of steam engine blown off:—High boiler pressure blew the cylinder head off a 100-hp. engine in a laundry in Toledo, O., and cracked the cylinder in several places. Fractures ran from the stud bolt holes back in the counterbore as far as the indicator pipe tap. The engine was condemned and a motor-generator set substituted at \$50.00 per month rental.

The Engineer took out the stud bolts where fractures existed, carefully cleaned the fractures, filled the holes with a soft putty of Smooth-On No. 1 and screwed the studs back until the Smooth-On oozed from each fracture. After cleaning the excess Smooth-On from cylinder walls and counterbore, he waited several days for the Smooth-On to metallize. He then put on the cylinder head and the engine went into regular service and carried the full load of 55 kw. without sign of leakage or weakness.



Cracked cylinder repaired and "never showed a weep." See text below

Repair to cracked cylinder:—A crack started in the 42-in. cylinder of a 22-in. x 42-in. x 30-in. cross-compound engine driving a 4,000,000-gal. pump in West Gloucester, Mass. This crack started under a flange and went to the bottom and then to the top of the cylinder.

Repairs with copper lacing and with lead poured behind two $\frac{1}{4}$ -in. thick patch plates were useless.

The crack was finally filled with Smooth-On No. 1, which was left exposed until it hardened. The outside was then covered with a mixture of Smooth-On Nos. 1 and 3 and the old patch plates applied. A small remaining space between the patch and flange was covered with the same mixture and a piece of $1\frac{1}{4}$ -in. angle iron, which had been heated and bent to the curvature of the cylinder. By means of temporary bolts and clamps, the angle iron was brought tight against the Smooth-On, and then cap bolts were applied as a permanent fastening.

The Chief Engineer told us after this patch had been in place and under steam pressure six weeks, that it had not shown so much as a weep, and that the cost of the repair, considering the results, was practically nothing.

Broken bridge wall in steam valve chest:—In September, 1920, while an oil tanker was trying to back into place for filling at Port Lobos, Mexico, the reversing engine could not be made to work. On removal of the steam cover, the bridge wall was found broken out, thereby permitting steam pressure in both ends of the cylinder to equalize. The gap was filled with Smooth-On No. 1 and in an hour the reversing engine was again at work, thus saving the company a big repair bill and keeping the ship in service.

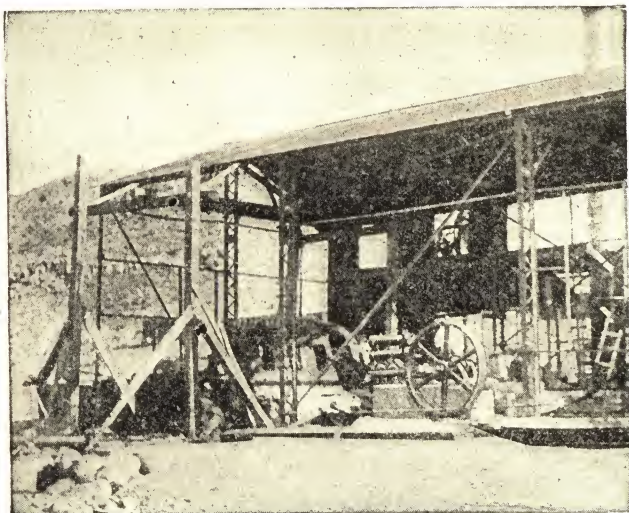
Cracked steam chest:—While the U. S. Naval Collier Nero was in Bordova Harbor, Alaska, during a gale, a hole opened in the steam chest of the anchor engine. Both anchors were down and could not be heaved up.

The engine was of the horizontal compound type, and the hole was on the lower side in a V-shaped hollow between cylinder and valve chest. The cylinders were removed, a patch was fitted as well as the location would permit, and the cylinder and chest were tapped for cap screws to hold it. Smooth-On No. 1 was applied and bedded by bowing down the patch plate with the cap screws. The repair remained thoroughly tight.

Cracked gas and oil engine cylinders:—The right hand engine cylinder of a 130-hp. engine driving the ore concentrating plant at Picher, Okla., cracked open just back of the middle exhaust port. The crack extended 3 in. back and through the cylinder wall into the cooling jacket. Water from the latter flowed into the cylinder, causing the engine to "miss."

No spare cylinder was at hand, none obtainable closer than the factory and a welder said that welding at the point where the crack was located was impossible, as the weld would be subjected to severe heat and strain. As a last resort, Smooth-On was mixed as directed, and pressed into the crack. The piston was put back and the job left standing over night.

Each day for a year afterwards this engine ran 20 hours out of 24, and at the end of that time it was still doing good work when a fire destroyed the plant.



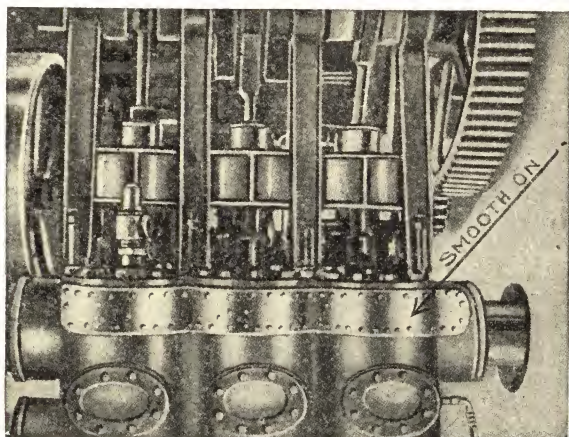
\$3000.00 saved by Smooth-On repair to a Diesel Engine valve seat

An exhaust valve seat 2 in. wide x $\frac{3}{4}$ in. thick in a German-made Diesel engine at Gage, New Mexico cracked at a time when a new part could not be had at any price. This crack caused new springs to burn out as fast as they could be put in, and prevented operation.

Making a new cage would have meant going to a foundry and machine shop several hundred miles away. Further, such shutdown would have been out of question, as during that period the mine would fill with water. This would mean weeks of idleness and pumping, besides the work of pulling the pumps out and putting them back.

The Engineer chipped out the outside edge of the crack to a V shape, spread it with a flue prosser, applied

Smooth-On No. 1, worked it well into the crack and then removed the prosser so the crack edges would squeeze the intervening Smooth-On. More was then tamped into the V. After giving the Smooth-On time to metallize, the valve seat was reground. This repair proved as good as a new valve cage, notwithstanding very high heat and air pressure ranging between 800 to 1200 lb. per sq. in.



Triplex pump cylinder block saved by Smooth-On repair

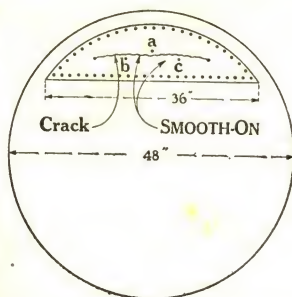
Triplex pump cylinder block:—A 15-in. x 12-in. triplex geared power pump at Copperhill, Tenn., was cracked through all valve chambers, the valve decks and one partition between the plunger cylinders.

The crack was repaired by the Chief Engineer so that the pump would operate without leakage, by applying Smooth-On No. 1 (Method B, Page 61) under a patch plate, bolted through valve chamber covers and valve decks, into good solid iron. The patch is shown in the picture.

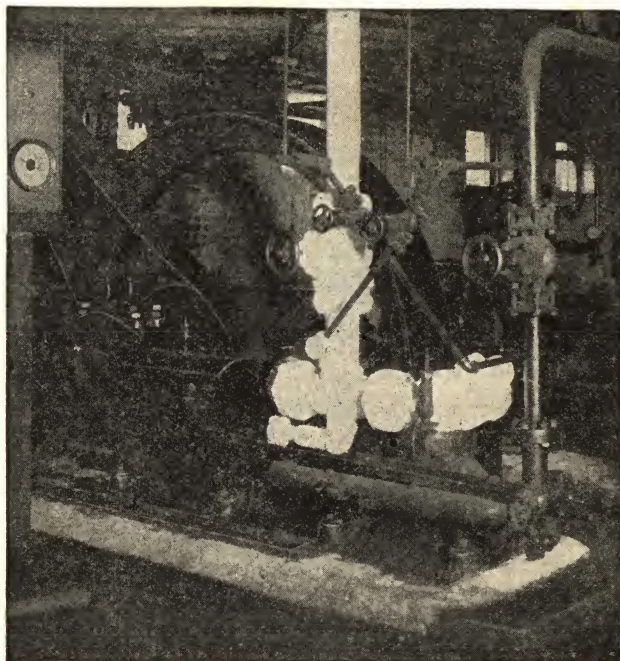
Pump cylinder:—The water cylinder of a pump at a colliery in Cambridge, O., froze and burst. Smooth On was forced into the crack and more spread over the surface and held under a $\frac{1}{4}$ -in. plate by four cap screws on each side. Six years later the pump was still working without sign of leakage at this crack.

Cracked cylinder heads:—Typical application of Smooth-On under a patch plate is shown in the diagram

of the 48-in. head on a cross-compound engine at a large electric power plant in New York. Holes at the end of the crack were drilled, tapped and filled with bolt ends to check extension. While the cylinder was hot and under partial vacuum, Smooth-On No. 3 was painted over the crack until no more was absorbed. A mixture of Smooth-On Nos. 1 and 3 was then applied as a thin even coating



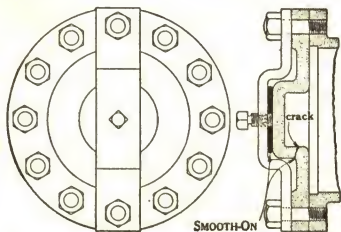
16-in. Crack in 48-in. cylinder head repaired perfectly with Smooth-On



Leakage developed from sand holes in a cylinder head on this 25-ton ice machine in Denver, Col. After welding failed to hold, the open spots were filled with Smooth-On No. 1 and a 10-day shutdown and the expense for a new cylinder head were avoided. Ten years later, after steady service under 180 to 200-lb. operating pressure, the Smooth-On repair was still absolutely tight

over the crack and the contact side of a steel plate which was $\frac{1}{2}$ in. thick and cut to a nice fit. The plate is held by $\frac{5}{8}$ -in. bolts at the edge and $\frac{3}{4}$ -in. bolts at a, b and c. The repair has proven thoroughly tight under the operating steam pressure, 150 lb.

A practical repair to the head on the steam end of a boiler-feed pump is shown in the illustration. The crack which had developed at the fillet, was filled with Smooth-On No. 3, which was partially

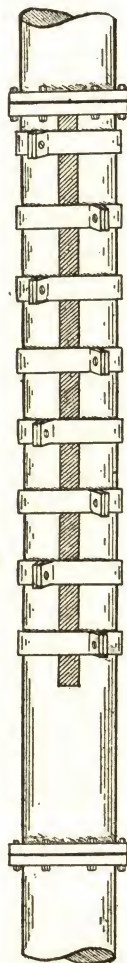


Smooth-On repair on a cracked cylinder head of a boiler-feed pump

drawn in by vacuum inside the cylinder. A piece of strap iron put across the head and fitted at center with a heavy set screw completed the job and made the crack permanently tight.

Plunger elevator cylinder:—Freezing while the building was tenantless caused bursting of one of the sections of the vertical cylinder of a passenger elevator at Battle Creek, Mich.

Smooth-On No. 1 in paste form was jammed into the crack by the Engineer, and a strip 1 in. wide and $\frac{1}{8}$ in. thick was left on the outside. This was covered by a 2-in. strip of boiler plate, bent to the cylinder radius and held by eight heavy clamps. The clamps were spaced equidistantly with joints staggered at either side of the strip, and in order to spread the Smooth-On into a thin layer under the strip, were put on before the Smooth-On was quite dry.



$4\frac{1}{2}$ -Ft. crack in plunger elevator cylinder repaired perfectly with Smooth-On

Not the slightest sign of leakage had developed after a year of constant hard service under the usual 125-lb. water pressure.

Cracked steam turbine casing:—Owing to stopping of a vacuum pump and breaking of the vacuum, water surged into a 500-kw. steam turbine in a textile mill in Plainfield, Conn. and cracked the exhaust end near the outer edge for two-thirds the way around the circumference. At places the crack was open almost $\frac{3}{16}$ in.

The casting was carefully drilled for $\frac{1}{2}$ -in. bolts to both sides and spaced about 10 in. apart along the circumference. The holes were placed to clear the bucket wheel. Washers were put under the nuts and candle wick previously soaked in a thin solution of Smooth-On No. 1 was wound around each bolt, under the washer.

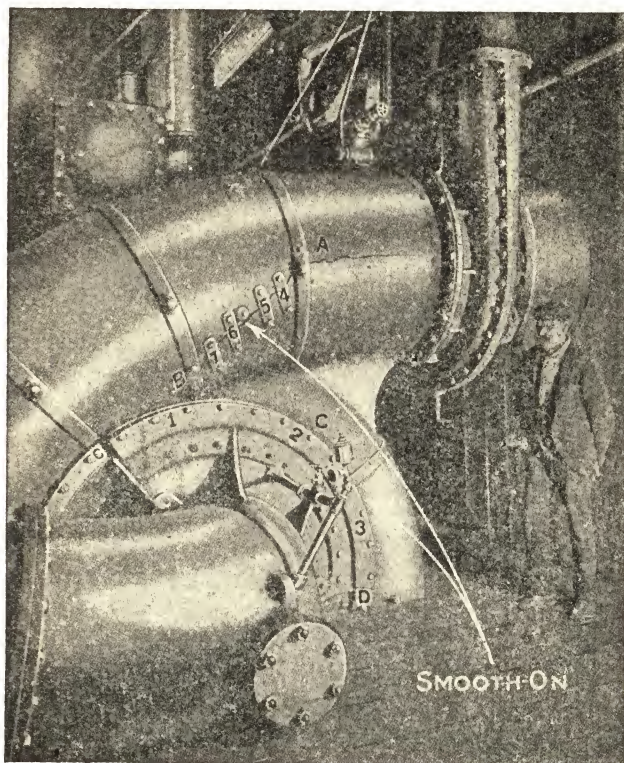
The crack was then pulled together, each bolt a little at a time, following around the circle. When the crack was nearly drawn up, the vacuum pump was started and a thin batter of Smooth-On No. 1 was put over and drawn in by the vacuum. The bolts were followed around to final tightness as the Smooth-On was applied, until the whole crack was pulled together tight. The surplus Smooth-On on the outside was smoothed over by hand, and at the same time an inspection was made for air leaks.

The turbine was put back into service after a six-hour shutdown and ran in this condition for six months, until a new exhaust head could be made and conveniently installed. During all that time there was no difficulty in maintaining 26 to 28-in. vacuum.

The Smooth-On repair avoided complete shutdown of this big plant, at least until outside power could be run in—an emergency which would have taken nearly a week.

Cracked centrifugal pump casings:—Due to a sudden strain, the shell of a 45-in. centrifugal pump in the U. S. Navy Yard, Brooklyn, split almost in two. The crack was over 20 ft. long and in places open almost $\frac{3}{4}$ -in. The pump was badly needed and could not be replaced for months, so the fracture was repaired with Smooth-On No. 1.

The pump (shown on Page 71) was fractured from A through B and C to D. Smooth-On No. 1 applied to the crack, and under brass patches 1, 2, and 3 and wrought-iron straps 4, 5, 6 and 7 kept this pump running for over ten years.

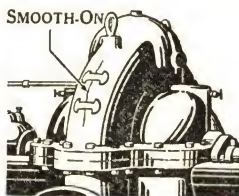


Burst 45-in pump restored perfectly with Smooth-On No. 1

A large centrifugal pump (30-in. suction line) developed a longitudinal almost straight-line crack 18 in. long, on top of the upper half of the discharge casing. A perfect repair was made as shown in the sketch, by employing Smooth-On No. 1 and links as described on Page 60.

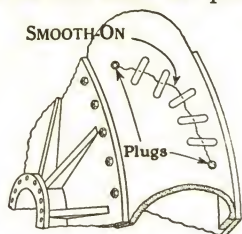
A crack in the discharge casing of one of the pumps of the U. S. Dredge Burton threatened to tie up the dredge for from 4 to 6 weeks.

The crack was repaired as shown in sketch, Page 72.



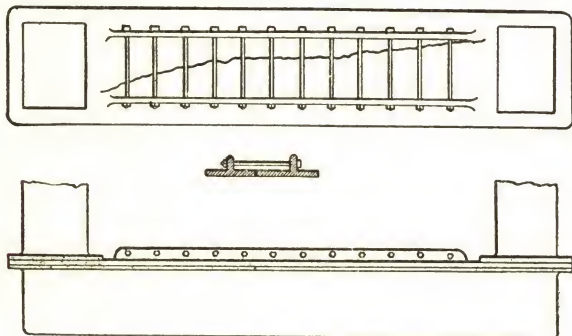
18-in. crack in pump casing made tight

It was drilled, tapped and plugged on the ends to prevent lengthening, and holes were drilled on each side of the crack, and spaced about 3 in. apart. The crack was then forced full of Smooth-On No. 1 and drawn together with staples as described on Page 60. The crack was closed so tightly that it could not be detected. *The whole repair was completed in less than a day.*



Crack made tight in casing of a dredging pump

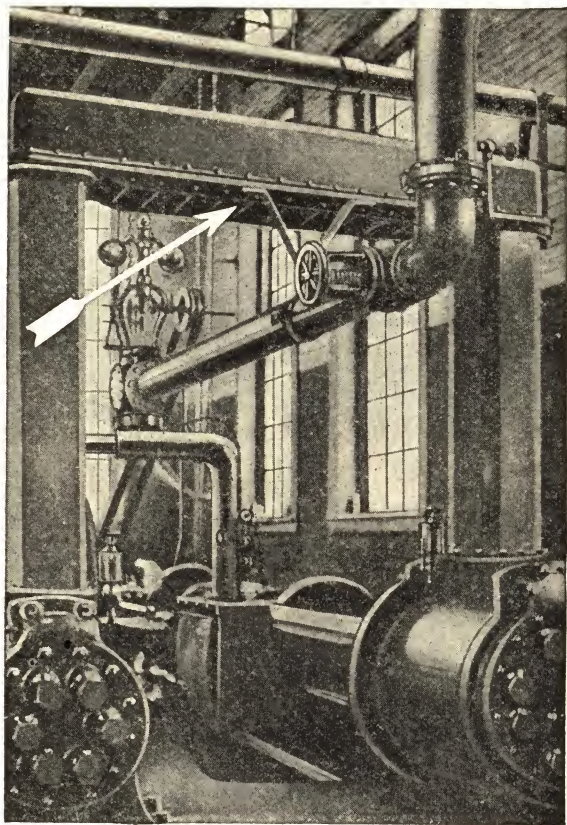
Cracked intercooler shell:—A crack in the intercooler (See picture on Page 73) on a 12-in. twin two-stage air compressor in a power house at Havre, Mont., spread to a length of over 5 ft. and opened up $\frac{1}{8}$ in.



5-Ft. break in intercooler repaired with Smooth-On No. 1

The two ribs shown in the cut were spaced and drilled to hold twelve $\frac{1}{2}$ -in. reinforcing bolts. These were loosely placed, Smooth-On No. 1 forced into the crack, the bolts drawn up, and the leak disappeared. After the Chief Engineer saw what Smooth-On did here, he said that it has no equal.

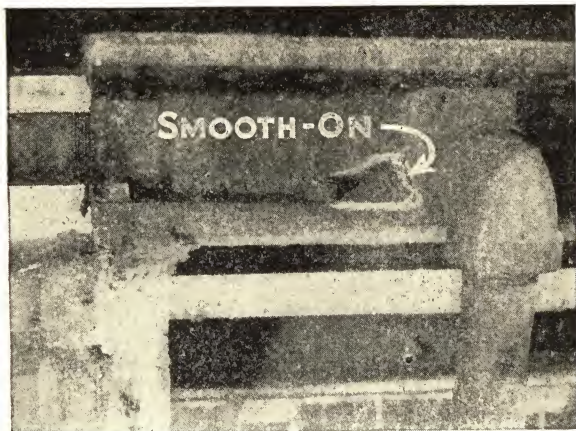
Leakage of oil from a reservoir under a thrust bearing compelled a South Berwick, Me., plant to shut down one of their main generators. After the bearing had become hot and burned out, investigation showed that the lubricant had seeped away through a number of little sand holes and cracks. These were cleaned off, chipped out and packed with a thin paste of Smooth-On No. 1, after which the oil reservoir remained tight.



Burstured intercooler repaired with Smooth-On No. 1

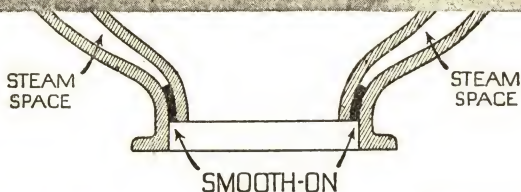
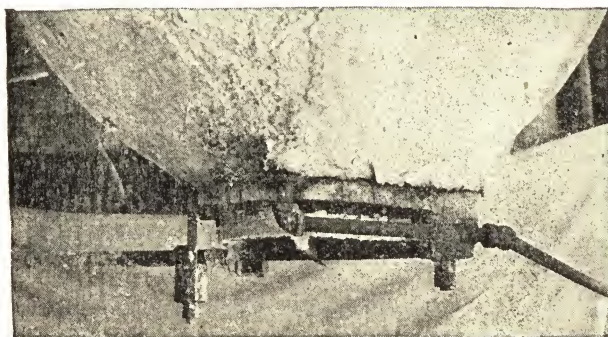
Sand hole in a cast foot-valve:—A flaw in the foot valve (See Page 74) of a cylindrical washer in a laundry in Washington, D. C. opened and let the steam and water out. The Engineer first wanted to drill and tap the hole but couldn't get the tools into place. Somebody suggested welding, but a welder wouldn't tackle the job for fear of doing more harm than good. The Engineer did not like the idea of putting in a new foot valve as this would have required taking out a big internal cylinder and cutting rivets.

With a torch, he burned the dirt off the ragged hole, and then poked in a stiff putty of Smooth-On No. 1



Leak at a sand hole. Stopped with Smooth-On No. 1

until the hole was completely filled. Next morning steam was turned on and the leak had disappeared.



This steam kettle dropped during erection at a plant in Jersey City, N. J., and sprung a leak at the bottom joint. All attempts to seal the break failed until Smooth-On No. 1 was applied. The Smooth-On repair remained perfectly tight after two years constant service under 60-lb. jacket pressure

Repairing leaks in steam jackets:—Leaks at seams and joints can be repaired with Smooth-On as described on Pages 45 and 36 to 42 respectively.

Cracks can be repaired by methods shown on Pages 59 to 61.

What Smooth-On can do for leaky steam jackets was well proven at Rock Hill, S. C., where three meal cookers were badly cracked at the mouth where the cooked meal was drawn out. Patches could not be put on the outside, so a handhole was cut through the outside casting into each steam jacket, to reach the seat of the trouble. After thoroughly cleaning all cracks, Smooth-On No. 1 was forced into them. After that hardened, the whole corner was heavily filleted with Smooth-On No. 1, and handhole plates with studs were fitted over the new outside holes. On starting, these jackets were perfectly tight and staid so for eight years.

Repairing cracked water jackets:—Water jackets of automobile, marine or stationary gas engines, oil engines, compressors, etc., which have cracked or even had pieces



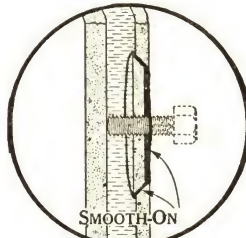
(A) Simple crack in water jacket



(B) Very long crack covered by patch plate



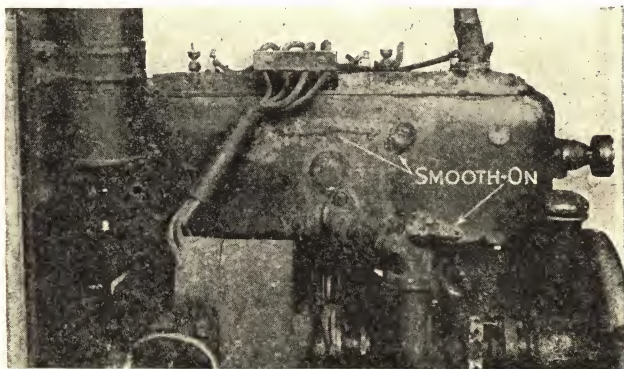
(C) Complete break with binding strap added



(D) Sand hole or thin spot replaced by inside plate

Application of Smooth-On No. 1 to breaks in water jackets

break entirely out from freezing or in fires, can be made watertight and good as ever for all practical purposes by mending the break with Smooth-On No. 1. Typical permanent repairs that are proof against heat and vibration are shown in Sketches A, B, C and D, Page 75.



This water jacket on the engine of a 2½-ton truck froze and burst in two places. Repairing the breaks with Smooth-On by Method A, Page 75, cost \$1.00 and gave perfect results. Taking down the engine, welding and reassembling would have cost \$150.00

For simple cracks (A) the Smooth-On should be forced into the crack as per directions on Page 59. Very long cracks (B) may require the application of a patch plate. In such cases the Smooth-On No. 1 is applied to the crack as directed on Pages 59 and 61, then a metal plate is made to fit over the crack and shaped to the contour of the casting and held by tap screws. A soft putty of Smooth-On No. 1 should be put under the patch to make it fit tighter. Pieces completely broken out (C) should be fitted back into place after coating the edges with a soft putty of Smooth-On No. 1. One or more binding straps formed to the contour of the broken area and applied as shown should be used as a reinforcement, or if the parts will not go back to a close fit, they should be covered by a patch plate. Additional Smooth-On should be put between under side of straps or plate and the jacket surface. If the broken parts tend to fall through in resetting, they may be held at proper position by pins that rest against the inner cylinder and held on the opposite end in holes drilled into the loose piece.

Large holes or thin spots in the jacket wall, may be chipped away to elliptical shape and fitted with a closing

plate as shown in D. The hole should be undercut with a file and the plate made to conform and tapped at the center for a set screw. After coating the edges of hole and plate with a soft putty of Smooth-On No. 1, the plate is inserted and the screw twisted until it rests firmly on the cylinder wall. When the Smooth-On has hardened, the outer end of the screw may be sawed off. If invisible repair is desired, more Smooth-On may be added over the plate to restore normal contour, and the whole painted.

All of these Smooth-On repairs are preferable to welding as the engine need not be taken down and no heat is required. The cylinder wall is not affected, whereas with welding, the distortion caused by the heat often necessitates reborings.

The savings and durability of Smooth-On water-jacket repairs are indicated below.

Automobile engines:—Mechanics wanted to take out a cracked water jacket and have it welded, at prices ranging from \$50.00 to \$150.00. Instead, Smooth-On No. 1 was applied (Method A, Page 75) and the leak stopped. Three years afterward the repair was as good as ever.

The engine water jacket on an automobile owned by a man in Avondale, Ala., burst with a single long crack. A welder wanted \$40.00 to make a repair and said possibly it wouldn't hold. The crack was cleaned out and filled with Smooth-On No. 1 (Method A, Page 75). This water jacket never leaked a drop afterward.

Freezing of an engine water jacket in a jitney in Providence, R. I., caused a break all around the top of one cylinder and across the center. The whole break was repaired by Method B, Page 75 in about 6 hours. Afterwards, at a time when this car had been driven over 11,000 miles more, the Smooth-On repair was still holding well. A new block and installation would have cost about \$125.00.

Oil Engine:—The water jacket of a 15-hp. oil engine at a college in Greensboro, N. C., froze and cracked slightly. Too much water ran out to permit proper cooling. The crack was filled with Smooth-On No. 1 under a plate (Method B, Page 75). Five years later the repair was still entirely satisfactory.

Marine engines:—The four-cylinder engine in the cabin launch of a Philadelphia broker, leaked at a small hole in the water jacket. The owner was told that two cylinders had to be removed enbloc for welding, but a better

informed mechanic made a perfect repair in two hours with Smooth-On (Method D, Page 75), without disturbing anything on the boat. The saving in time and money is obvious.

A crack in the engine water jacket of a motor boat in Patchogue, L. I., caused water to fall on the ignition system and paralyze it. Everyone said a new cylinder would be necessary, but instead, the crack was cleaned and filed, and filled with a paste of Smooth-On No. 1 (Method A, Page 75). Three years later the repair had never leaked a drop.

A 3-in. by 4-in. piece that broke out of the jacket of a single-cylinder marine engine in Worcester, Mass., was fastened in and the leak sealed by Method C, Page 75. The owner repaired the break perfectly himself with Smooth-On No. 1. The lowest estimate on a welded repair was \$5.00.

Mechanical shovel:—A cracked water jacket on the 60-hp. gasoline engine of a 29-ton shovel at Albany, N. Y. had a crack 6 in. long, $\frac{1}{4}$ in. wide at the center and bulged $\frac{1}{4}$ in. out of place. An expert welder, said that the cylinder would have to be taken down, brought to his place, and given a special heat before it could be welded. That meant some hard work, several days lost time, and the valves would have to be reground.

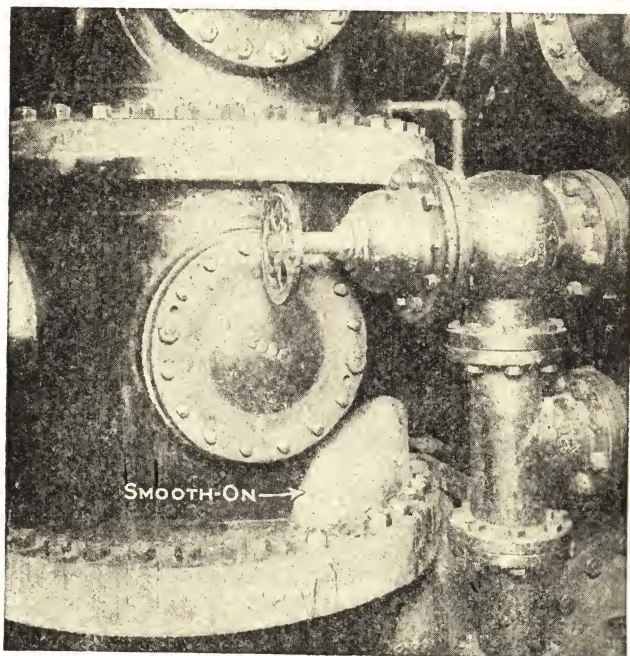
Instead, a practical repair man filed and sandpapered the crack, forced in Smooth-On No. 1 and in less than two hours the shovel was again on the job. After a month of hard work for the shovel, and moving over 32 miles of rough road, the repair was perfect. Subsequent jolting and vibration had no effect on the Smooth-On and the repair is hardly noticeable.

Making porous castings tight under any pressure

POROUS spots in the walls of pressure containers seldom show their weakness until after the part is installed and in service for some time, which usually means that the cost of labor for disassembling and re-assembling plus the cost of a new part would make a very expensive repair job.

With the aid of Smooth-On No. 1 or No. 3, or a combination of them, a porous part can be made to stand any pressure, and often the Smooth-On can be applied with comparatively no disassembling and plant shut-down.

No exact instructions can be given for applying the Smooth-On owing to wide differences in granular structure, contour and pressure at such faulty parts.



Porous water chamber casting made tight with Smooth-On. No leakage afterwards under daily 200-lb. service pressure

A method which with slight modification, usually produces an entirely successful repair, was utilized on the lower water-chamber casting (see illustration) of an elevator pump in a New York City apartment house. The porosity developed here after three years of operation, and the pores on the inside of this casting could hardly be detected by the naked eye.

The inside surface was thoroughly cleaned, a steam connection made to the chamber, and 125-lb. steam pressure applied for two hours. Then with all openings closed, the steam inside was allowed to cool, and form a vacuum to draw all foreign matter out of the small pores. After repeating this process three times, Smooth-On No. 3 was applied on the inside and put under 50-lb. steam pressure

for one hour to force it into the minute openings. This also was done three times.

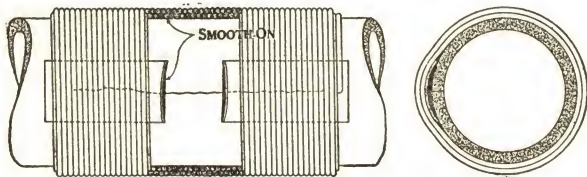
The pump afterwards worked constantly under the 200-lb. pressure head of the elevator service without sign of further leakage.

In another instance, a spongy steel casting on a 60-ton accumulator at a power plant in Pittsburgh, Pa., caused a very bad leak.

Two hundred pounds of Smooth-On No. 2 applied according to our directions made a repair which withstood the water pressure of 850 lb. per sq. in. with entire satisfaction.

Repairing breaks in pipes, fittings and valves

CRACKED pipes:—Cracks in pipes may be repaired with Smooth-On No. 1 by the methods described on Pages 59 and 87. Another effective way to stop leakage is indicated in the diagram on this page. Wire is wrapped in a double layer around a thin dished plate placed over the leak and filled with Smooth-On No. 1. Additional Smooth-On put on the top of the plate and over the rest of the pipe will make the wire and pipe one solid mass. This repair also strengthens the pipe against bursting. The wire should be drawn tight so that it will bind.



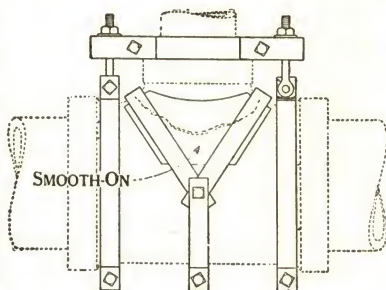
Method of stopping a pipe leak with Smooth-On No. 1 bound under a thin plate and wire

This type of repair was applied by the Engineer of a Chicago hotel when a steam pipe split for about 1 in. and $\frac{1}{8}$ in. wide at the center. The whole repair took only an hour, although the break developed at a place where the pipe ran through a 12-in. by 12-in. metal beam, and where it had to be disconnected at unions and partially pulled out to reach the bad location. Next morning steam was turned on as usual, and there was no further leakage during the following six years, after which the building was torn down.

An emergency repair that saved the contents of an acre of greenhouses:—At a greenhouse plant in Wooster, O., an accidental blow on a 4-in. hot-water heating system pipe, plus strain from a sagging line, caused a 7-in. x 7-in. x 4-in. tee to break around the 4-in. opening, and the hot water spurted out as from a geyser. The break was located where it prevented water circulation in the whole heating system.

This was in January, 1920, when the outside temperature was near zero, and when an inside temperature below 32 deg. would have frozen and ruined every plant in the whole stock. The manager had visions of being put out of business for the rest of the season. On reviving from the shock, he rushed a man to a blacksmith to have a strap-iron harness and plates made as shown in the sketch.

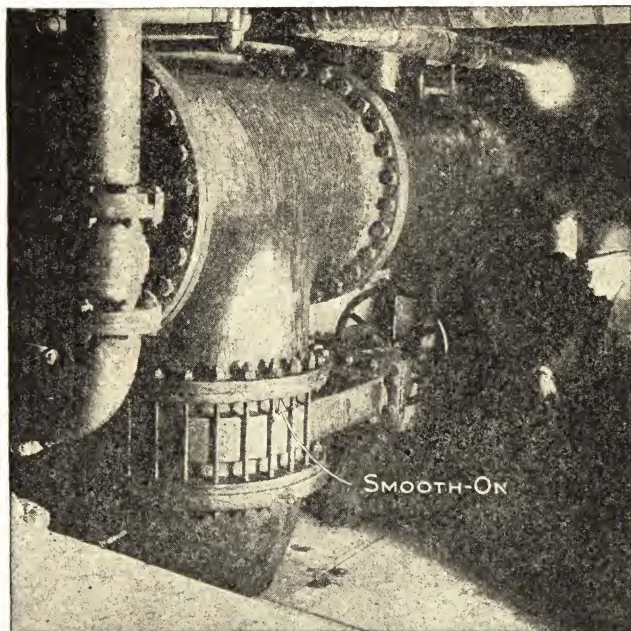
In the mean time valves were closed and fires banked, but the water still gurgled out of the break as from a jug.



Emergency repair for a cracked iron tee

The crack, which was about $\frac{1}{4}$ in. wide was jammed full of jute. A 6-in. x 2-ft. strip of burlap was spread on the floor and covered with Smooth-On No. 1 to a thickness of half inch at the middle and tapering to nothing at the edges. This was wrapped around the crack and temporarily tied with twine. The harness and plates were then applied and drawn up until the Smooth-On squeezed out all around the plate edges. Two hours after the leak, the clamps were given the final tightening, as the Smooth-On had hardened, and water was turned on gradually. The repair held and the plant was saved. Four years afterward the repair was still good under pressures up to 40 lb. and gives every indication of holding indefinitely.

Cracked valve bodies:—A 30-in. gate valve in a condenser suction line in Chicago cracked all the way around under the top flange. The Chief Engineer cleaned the crack, filled it with Smooth-On No. 1, put rods across and drew them up (See Page 82). Two years later the valve was still working as well as when new.



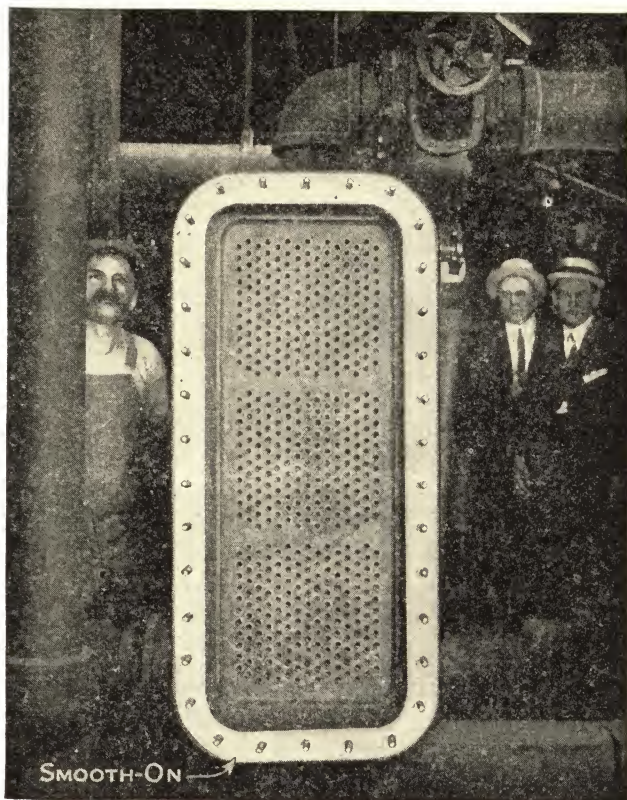
Cracked 30-in. valve made good as new with Smooth-On No. 1

Protecting and restoring surfaces subjected to corrosion and erosion

*For Corrosion and Pitting in Boilers, see Pages 47 to 54;
Steam-cut Grooves in Threaded Joints, Pages 21 to 30;
in Flanged Joints, Pages 21 to 28; in Renewable Valve
Seats, Pages 29 to 31.*

RESTORING pressure-tightness at corroded contact faces:—Rust and erosion from chemical impurities in the surrounding fluid frequently eat deep enough into contact faces to cause ever increasing leakage. The resulting pits or depressions can be built up with Smooth-On No. 1 to make the contact or gasket face as smooth and perfect as when new. All that is necessary is to clean out the depression thoroughly, tamp in a stiff putty of Smooth-On and true up the surface.

The success of this procedure was typically shown at an ice plant in New York where the steam condenser shown in the picture developed a bad leak between a



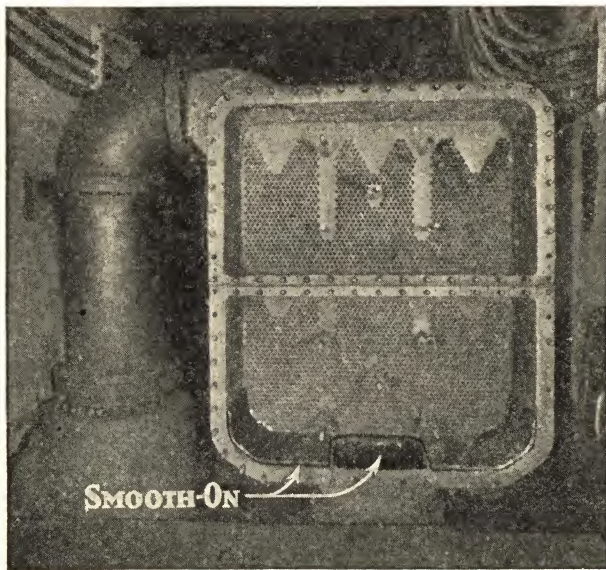
Corroded and leaky condenser contact face. Built up and made tight with Smooth-On No. 1

tube sheet and the shell. On disconnecting, the gasket face was found to be badly eaten away, and, due to the imperfect face and edge of the casting, a tight joint could not be made with a rubber gasket.

The uneven places were filled with Smooth-On No. 1, and after letting the cement set for 36 hours, the gasket was replaced and tested. This joint has remained tight.

Protecting shells and casings subjected to abrasion:

—Gritty solids carried along with water will sooner or later cut through any surface with which they come into contact. Where it is practical to build up or reinforce the



The Smooth-On repair on this 3000-kw. condenser saved at least \$50.00 in labor and \$500.00 for a new water end.

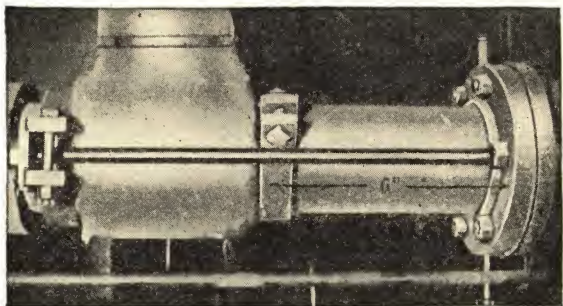
worn surface by sheet metal or plates, Smooth-On makes a strong solid backing between the new metal and the old.

This procedure was very successfully utilized in an electric power plant in Astoria, N. Y., where scraps of marble thrown into adjacent water by a marble yard, entered the circulating water inlet and wore holes through the bottom of the water box of a 3,000-kw. condenser. (See picture.)

The Engineer mixed 5 lb. of Smooth-On No. 1 with 5 lb. of Smooth-On No. 3, scraped down the metal at the holes, and applied the Smooth-On mixture under two $\frac{3}{8}$ -in. plates which had previously been fitted to the water box. The plates were fastened by bolts at places where the metal was still strong. The job was completed in four hours, and 12 years later was still thoroughly satisfactory.

Checking corrosion from the exhaust gases of internal-combustion engines:—The heat and destructive gases in the exhaust from high-powered gas and oil engines are particularly severe on joints close to the

combustion chambers. Smooth-On No. 1 being uninjured by heat, is by far the best joint filler that can be used at these locations.



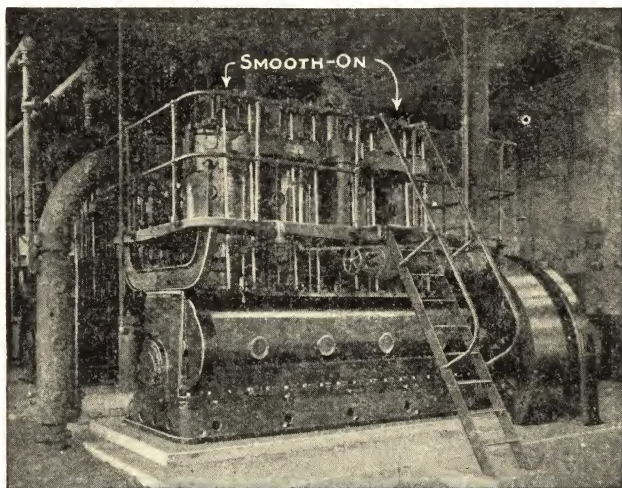
Gas engine connection that fell apart from corroded threads.
Made perfectly tight with Smooth-On No. 1

This was well proven in the plant of a Pittsburgh office building where a 125-hp. gas engine had a 6-in. nipple (see picture) leading from a flange to a 6-in. tee in an exhaust riser. The threads on the nipple and in the tee became so badly corroded that the nipple slipped out of the tee, leaving an almost smooth surface without threads.

A new nipple was secured and its threads filed down so that it would partially enter the tee. The end of the nipple and the inside of the tee were then given a heavy coat of Smooth-On, forced together, and a clamp put around the pipe to hold the Smooth-On paste close up to the fitting.

The Chief Engineer told us a year afterwards that no signs of leakage had developed—rather good evidence that Smooth-On repairs withstand high temperature and vibration.

In another instance, a 400-hp. gas engine, installed at Canby, Minn., and shown on Page 86, leaked water into No. 1 and No. 4 cylinders. The water was getting into the heads along the relief cocks, which extend from the outside of the head through the water jacket space to a recess in the cylinder head. Only a thin portion of casting separated the jacket water from the relief cock, and during 18 months previous service, part of this thin portion of casting had been eaten away. The first solution appeared to be two new cylinder heads at a cost of



\$1200.00 was saved by the Smooth-On repair where the metal had eaten away and let water into two cylinders of this 400-hp. gas engine. See text

about \$1,200.00. However, as Smooth-On had proven satisfactory in repairing leaks on gas producers at this plant, it was tried on this engine.

The engine cocks were first threaded their entire length and the hole in the cylinder head was tapped. Smooth-On No. 3 was then applied to the relief cock and the cock screwed into the cylinder head. The job was allowed to set for 24 hours, and on trial, both cylinder heads were found to be perfectly dry and tight.

This engine afterward ran 12 hours per day for over four years, with these same cylinder heads, and without any trouble whatever.

Stopping leakage in pitted and eroded wrought-iron sewer pipe

The following method of using Smooth-On to restore water tightness of corroded or scoured iron pipe is unique but offers practical hints which can sometimes be employed to advantage.

A wrought-iron riveted pipe that had carried sewage in Jersey City, N. J., for 35 years, had long been enclosed in the masonry of a bridge, except for a 50-ft. exposed portion under an arch.

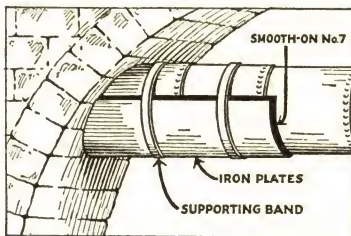
Outside pitting and inside scour caused bad leakage all along the bottom of the exposed portion and as the pipe was sometimes full and under pressure, a quick repair became necessary.

It was figured that a Smooth-On repair would be advisable. The pipe was cleaned on the outside and given first a paint coating of Smooth-On No. 2 and then a plaster coat, stopping all leaks.

The concrete arch was cut away from underneath the pipe, to allow semi-cylindrical plates covering the lower half to enter 12 in. into the masonry. These plates were $\frac{3}{16}$ in. thick, about 10 ft. long, and curved to a radius about 1 in. greater than the greatest outside pipe radius. Joints between the plates were made by butting the ends together and covering with a $\frac{3}{16}$ by 8-in. iron band, which passed entirely around the pipe. Between the joints were two $\frac{3}{16}$ by 4-in. bands, which also bound the semi-cylindrical outside shell to the old pipe. The inner surfaces of all bands were carefully coated with soft cement before putting into place.

The space between the shell and the pipe ($\frac{7}{16}$ to $\frac{7}{8}$ in.) was then poured full of a mixture consisting of equal parts by volume of Smooth-On No. 7, sharp sand, and portland cement. The top of the pipe was then plastered over with a coating of the same mixture applied with a trowel. When completed the pipe was as good as new.

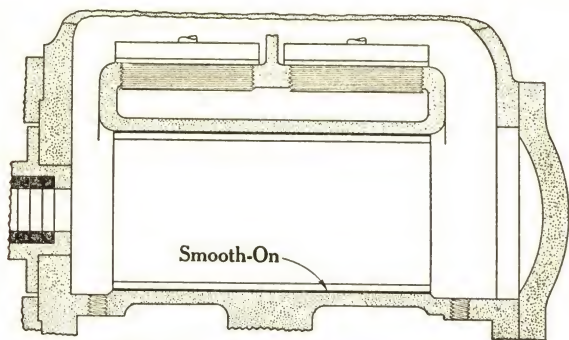
The lowest bid for a practical repair with any other method and material was \$3,600.00—the cost with Smooth-On was only \$1,000.00. The work was carried out under direction of the Construction Engineer of the Jersey City Street and Water Dept.



This Smooth-On repair saved \$2600.00 and required a minimum of time

Anchoring cylinder linings

THE expansion of Smooth-On No. 1 in metallizing, peculiarly adapts it to this work in that all voids are filled and the liner is solidly backed and wedged at every square inch of its outer surface. It is only necessary to wipe the solid metal and the outside of the liner clean and coat these surfaces with a thin putty of Smooth-On



Cylinder liner anchored with Smooth-On

before pulling or pressing the liner into place. This is much simpler than treating the contact surfaces and wiping them with solder, and is equally effective with either brass or steel liners. No heat is required, and there is no uncertainty about the bond as with solder. A liner set with Smooth-On No. 1 remains solid until completely worn out, when a renewal may be placed in the same way.

The following examples indicate why Smooth-On No. 1 should invariably be used in setting all cylinder liners.

The barrels in the water end of a 6-in. x 4-in. x 6-in. duplex boiler-feed pump at a Minneapolis (Minn.) factory had been rebored in overhauling and fitted with $\frac{1}{32}$ -in. oversize liners. When these oversize liners were worn out, the next set, ordered from the pump builder, were of the old size and when put in were of course entirely too loose. Solder was wiped on the outside, and the liners pulled into place, but instead of staying put, they moved back and forth with the pistons. Then Smooth-On No. 1 was applied to the surface of the pump barrels and the liners pulled in again. Five years later there had not been any sign of further movement. This repair saved the cost of a new pump, and avoided serious shut down.

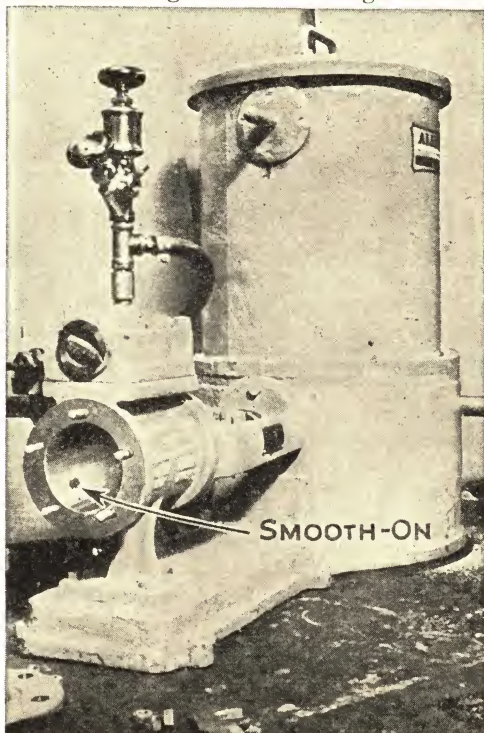
In 1910 an old power boiler-feed pump was taken off a junk pile at Webster, Mass., and the cylinder metal was found to be too bad for reboring. New cylinder liners were made from two pieces of steel tubing, and the insides of the cylinders and the outsides of the liner tubes were coated with Smooth-On No. 1. The liners were then pressed into place and when reamed, made the cylinders as good as new. The old plungers were then turned to the new cylinder diameter. The stuffing boxes were then

too large, so they were cleaned well, coated inside with Smooth-On No. 1 and steel tubing was pressed in exactly the same way as in the cylinders.

After 14 years subsequent service in a plant in Webster, the cylinder and stuffing box liners of this pump were still as solid as the shell metal. From the way the pump worked no one could tell that it had been repaired, and after the 14 years it was still good for many more years of satisfactory service.

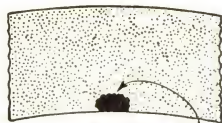
Restoring pitted or deeply scored surface in cylinder walls

IF the score or pit is shallow it should be made deeper with straight walls and rough bottom, as Smooth-On will metallize and cling better to a rough surface than to



Smooth-On No. 1 filled into cylinder pits in this heavy-pressure grease pump stopped leakage past the piston, See Page 90

a smooth one. After removing rust and foreign matter, Smooth-On No. 1 should be applied until the depression is built up to normal surface. The surface of the repair should be dressed to cylinder curvature and smoothness with a file and emery cloth, after which loose particles should be washed off with oil, to have a clean surface.



SMOOTH-ON

Cylinder surface restored with Smooth-On No. 1

Typical benefits from Smooth-On were shown in connection with the experimental high-pressure pump shown on Page 89. This pump supplies grease at 2,000 lb. per sq. in. by continuous balance from 125-lb. air pressure on the piston. To reduce leakage past the piston, the metal piston rings had to be replaced with cup leathers. Several blow holes in the cylinder wall prevented the change from being successful until the holes were filled with Smooth-On as described. The cylinder, made perfectly true in this way, was saved by Smooth-On and is now doing good work.

Making vacuum lines tight

LEAKS in vacuum lines are particularly treacherous in that no visible evidence helps to determine their location. Here is a typical instance: A 16-in. flanged joint in an exhaust pipe at Martins Ferry, Ohio, leaked so badly that when the engine was operated condensing, only 22-in. vacuum was obtainable. The management would not believe a leak existed as no steam escaped when running non-condensing. What actually happened was that expansion of the metal at the higher temperature of non-condensing service sealed the opening *at that time only*. Smooth-On No. 3 was drawn into the joint, after which 26-in. to 27-in. vacuum prevailed in condensing operation.

Wherever trouble is experienced in keeping the vacuum high, all joints should be carefully investigated and Smooth-On No. 3 painted liberally over those that are under suspicion. The vacuum pulls the Smooth-On into the open spots and the leakage will stop almost at once. If the leak cannot be completely stopped in this way, Smooth-On No. 1 under a Smooth-On Pipe Clamp (see Page 21) should be put over the Smooth-On No. 3.

That welded joints need the same inspection as threaded or flanged joints is proven by experience at a Los Angeles plant where all the joints on the intake lines to two 1,400-hp. barometric condensers had been welded. Leaks in these joints brought the vacuum down to 23 in. mercury, but after treatment with Smooth-On No. 3, a 27-in. vacuum with corresponding improvement in engine performance was easily obtainable, and the joints remained thoroughly tight.

Repairing leaks in a corrugated expansion joint

WHILE overhauling the 750 kw. turbine in a plant of a Colorado power company to find out why the vacuum dropped several points, the Chief Engineer discovered bad corrosion and pitting on the edge of the top roll of the expansion joint between the turbine and condenser. The corroded and pitted area was about 2 in. square and several sand holes went clear through the metal. One of the latter was $\frac{1}{8}$ in. in diameter. No one who attempted soldering could make the solder hold, and a mechanical patch was impossible because the outside of the joint could not be reached.

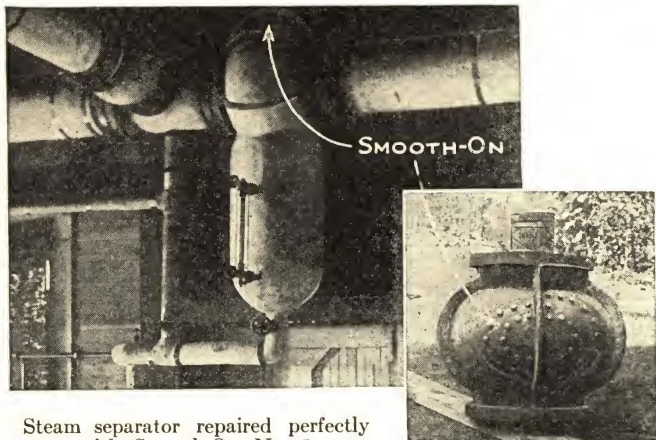
Unless the repair could be made in place, that is, without removing the joint, the turbine casing would have to be opened, or the condenser and valve and tie would have to be moved. Either would have been an expensive job, and as no reserve power units were available, the company could not tolerate long shutdown.

The metal at the defective spot was therefore cleaned and Smooth-On No. 1 was hammered into all depressions and holes. The Smooth-On was then covered with a bronze plate held by bronze cap screws to make the seal complete.

No sign of leakage could be detected six months later, the vacuum had been constantly up to maximum from the time the repair was finished, and the repair appeared good for the life of the joint.

Cracked steam separator

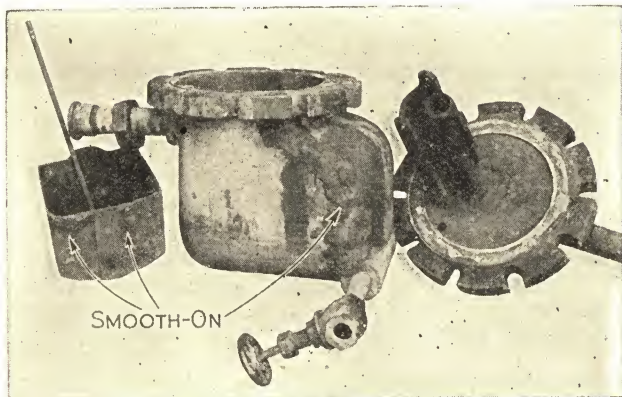
AN 8-in. steam separator at Conway (N. H.) cracked across the top in two places. Smooth-On No. 1 applied and held in place with two bolted patch plates of $\frac{1}{4}$ -in. iron made a perfect repair. (See picture, Page 92).



Steam separator repaired perfectly with Smooth-On No. 1

Repairing steam traps

STEAM traps are often located where they may freeze when out of service, and bursting may also be caused at a weak spot by excessive pressure. Cracks so developed and cracks at welded connections may be repaired by applying Smooth-On No. 1 as directed on Page 59.



This trap which had frozen and burst, was repaired by applying Smooth-On No. 1 at two places on the bucket and at a crack on the body. A year afterward, it had given continuous perfect service every day at 60-lb. steam pressure, and still had the same usefulness and reliability as a brand new trap

An interesting repair was made at Rochester (Minn.) where a trap developed a hole due to corrosion or a casting flaw near the valve seat. The correct diagnosis was found only after disassembling and putting in an electric light bulb, after which light could be seen through the outlet chamber partition. This hole formed a by-pass, through which steam escaped without reaching the valve seat.

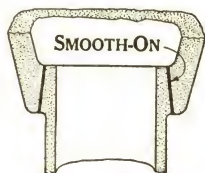
The trap was disconnected, dried and the defective location sand-papered. Smooth-On No. 1 was then forced into the hole and the surface evened. Four years after this trap was put back into service, it was still working perfectly under the usual 80-lb. pressure, and had not even been opened for cleaning.

Stopping leaks in fuel economizers

LEAKAGE in fuel economizers may occur at the flanged inlet and outlet connections, at the hand hole covers, at the tube joints, at sand-hole flaws in the tubes and at cracks in the headers.

Remedies suitable for the first two are described on Pages 31 and 52, respectively. The others are as follows:

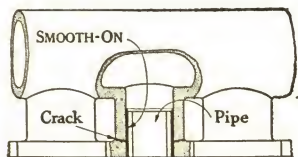
Tube joints.—As the tubes are of cast iron, “rust” joints (see Feed-water Heaters, Page 96) have been much used by the builders.



Tube joint made with
Smooth-On No. 1

Smooth-On No. 1, used as shown in the diagram, makes a safer connection than a rust joint, which means less labor and expense in repairing leaks and setting new tubes.

This Smooth-On method has been used for years at a filtration plant in Washington, D. C., and no tube set with Smooth-On has ever leaked. The Economizer here carries 165-lb. working pressure, is served by flue gases entering at 450 deg. fahr. and delivers at temperatures up to 260 deg.



Cracked header neck repaired
with Smooth-On No. 1

Cracks in headers.—These can usually be repaired by the simple methods described on Pages 59 to 61. An effective repair for cracked header necks is shown in the diagram. This was employed in a large power plant in Re-

gina, Sask., Canada, where getting a new header from the builder would have meant a very long delay.

A length of wrought-iron pipe was ground down to fit the neck of the casting, leaving $\frac{1}{16}$ -in. clearance into which Smooth-On was filled as a soft paste.

After the repair had given perfect service for six years under 150-lb. pressure and 160 to 220 deg. temperatures, the economizer was moved to another power plant, where it has since seen seven more years of service delivering at 160 deg. fahr. and 10-lb. pressure.

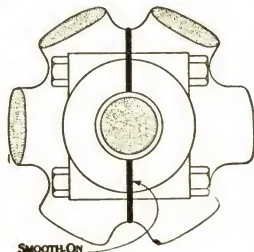
The saving of a Smooth-On repair was well demonstrated at a plant in Fargo, N. D. The 1600-hp. economizer here is composed of 36 sections of eleven 9-ft. tubes each, operates at 175-lb. pressure and 200 to 260-deg. temperature, and is so located that leakage would be disastrous.

In 1917 two cracks developed in cast-iron headers of two of the sections. One crack extended from one tube to the next and the other was shorter. Grooves about $\frac{1}{2}$ -in. deep were chipped along the cracks with a diamond point chisel, filled with Smooth-On No. 1 and allowed to set for 24 hours. After seven years continuous night and day service, no trouble has been experienced with the repaired headers.

During this interval, two other sections were removed for other reasons and replaced at a cost of \$1060.00. On this basis, the Smooth-On repair which cost \$5.00 saved \$1055.00. Besides, it would have taken at least 30 days to get two sections from the factory and put them in place, whereas the Smooth-On repair was made in 36 hours. Figuring on the saving in fuel by keeping the economizer in service almost all of these 30 days, the Smooth-On repair also saved about \$450.00 in fuel.

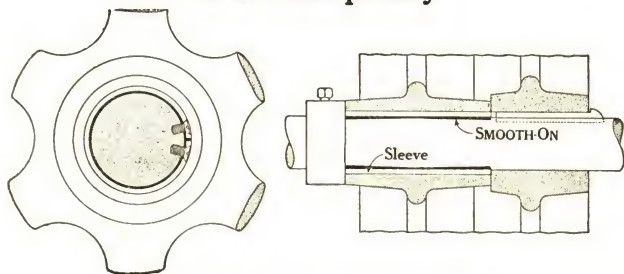
Preventing fly wheel looseness and squeaks

FLY wheels sometimes show very slight looseness at the shaft. This can be taken up perfectly by setting the key in Smooth-On No. 1, or if it happens to be a large wheel with split hub, a procedure utilized by an engineer in Lafayette, Ind., is very effective. In this plant a 10-ft. split fly wheel continually worked loose and



squeaked in spite of all efforts to stop the nuisance. The Engineer finally plugged the hub openings at each side, turned one opening to the top, poured in a thin mixture of Smooth-On No. 1 and let it set over night. The next morning he turned the other opening to the top and did the same thing. Six months afterward the fly wheel was still tight, and the Engineer was still rejoicing at having the trouble stopped.

Repairing a worn shaft and bearing in a loose pulley



Worn shaft built up with Smooth-On

A UNIQUE and effective Smooth-On repair that is often practical is best explained from actual work done by a master mechanic in Louisville, Ky.

A $2\frac{1}{16}$ -in. shaft in a mill was worn to $2\frac{3}{8}$ in. on one edge and $2\frac{1}{2}$ in. at the other at the location of a loose clutch pulley. The wear had become so serious that the clutch would no longer hold and could not be kept cool when running idle.

The following Smooth-On repair was decided upon: The high spots were partly filed, and a $7\frac{1}{2}$ -in. length of $2\frac{1}{2}$ -in. extra heavy pipe was turned to $2\frac{3}{4}$ -in. outside diameter and split on one side only with a hack saw. Three $\frac{1}{4}$ -in. screw holes were drilled and countersunk on each side of the saw cut. The pipe was slipped and driven over the shaft to the worn place, clamped tightly, the shaft drilled and tapped to receive the screws, and the screws inserted to hold the pipe tightly. This made the pipe just touch the shaft at the high spots ($2\frac{1}{2}$ -in. diam.) and open at the $2\frac{3}{4}$ -in. diam. and intervening spots. The ends of the pipe were temporarily filled with putty to form a mould, and a thin mixture of Smooth-On No. 1 poured into the crack left by the hack saw. The pipe

sleeve was tapped lightly with a hammer during the pouring so that the Smooth-On mixture would completely fill the void.

The inside pulley bearing, which had worn conical, tapering to the center, was bored and bushed to the new diameter, $2\frac{3}{4}$ in. and slipped over the pipe sleeve.

Next morning this shaft line went into service and after 30 days the repair had proven perfect and had all the appearance of permanence.

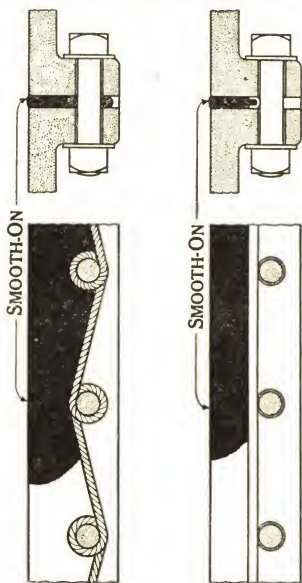
Securing watertightness and stopping leaks at the joints of cast-iron sectional feed-water heaters and tanks

CAST-IRON sectional feed-water heaters, chemical purifying and storage tanks, etc., are not usually machined or finished at the joining edges of the plates, and for watertightness.

Many of the largest builders of cast-iron tanks have adopted Smooth-On No. 2 (slow-hardening) as a joint filling and use it as indicated in the diagrams, thereby making a *permanently* tight joint with little effort.

The Smooth-On No. 2 is applied to the flange or lap seam, with a trowel or putty knife or it can be worked into the crack by light tamping. Oakum can be strung over the bolts as a temporary backing, or a thin wooden or metal strip forced against the bolts is easier to place and serves just as well. In fact no backing need be used at all, if the Smooth-On is applied to shallow depth at the inside and left to harden, after which more Smooth-On filling can be troweled or tamped in from the outside.

Smooth-On adheres firmly to the surface before metal-



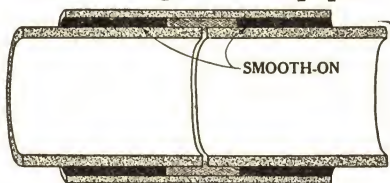
Two methods of holding Smooth-On in the joint in tamping. The backing can be formed either by wick strung from bolt to bolt or by U-shaped strips of thin metal, or strips of wood, wedged against the bolts

lizing, and where used, a plate may be handled freely without fear of the joint material dropping off. The Smooth-On metallizes slowly enough to permit deliberate assembling and adjustment, and when hardened, makes a joint which will withstand water, steam, oil or fire.

Repairs:—If by any chance, leakage develops in service, a repair can be made *from the outside* and usually without draining, by merely scraping out old filling and caulking Smooth-On No. 2 into the void.

The same procedure may be followed for leaks in wrought iron heaters or tanks with welded seams. An open heater at a plant in York, Pa., leaked at the corners for four years and acetylene welding failed to hold. The heater was drained and Smooth-On No. 1 was applied to these seams. When last heard from, four years later, the Smooth-On repairs were still tight.

Making emergency joints on cast or wrought-iron pipe



A practical emergency joint

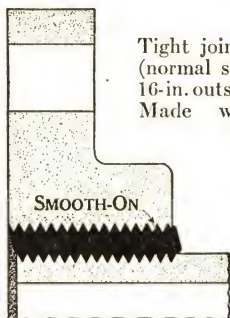
A JOINT must sometimes be made between broken or cut off ends of cast-iron pipe. Also a suitable coupling or threading tools for the usual type of joint on wrought-iron pipe may not be available.

An emergency joint that is simple to make, permanently tight and meets all needs is shown in the illustration. The coupling is formed from a section of pipe two to three times as long as the diameter of the line, and enough larger in diameter to provide $\frac{1}{8}$ -in. to $\frac{3}{16}$ -in. annular space, which is packed at the center with oakum, and then filled with Smooth-On No. 1. The Smooth-On should be tightly caulked, and when metallized, makes a joint that is as solid as standard construction.

This idea was utilized by the Superintendent of a Pittsburg, Kans. power plant, when a steam line in the plant tore itself out of 8-in. flanges, due to the slipping of an anchor block. The broken flanges were removed,

and as the pipe could not be gotten back, a cast iron sleeve was slipped on and caulked with Smooth-On No. 1. Steam was turned on again the same day, thereby saving customers much discomfort as the accident happened in very cold weather.

Making a tight joint between threads and oversize fittings



Tight joint between 16-in. (normal size) flange and a 16-in. outside diameter pipe. Made with Smooth-On No. 1



THIS stunt comes handy when wrong size fittings are sent by mistake and none other are available. It is well explained by the experience of a waterworks superintendent, who had ordered a 16-in. steam separator with companion flanges and 16-in. pipe. After the separator had been placed, it was found that the pipe received was 16-in. outside diameter. Reducing flanges could not be obtained in less than 15 days, but such a delay was out of question.

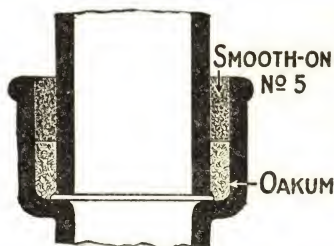
There was nothing to do but use the larger flanges and fill the $\frac{3}{8}$ -in. annular gap at the threads with Smooth-On No. 1 as shown in the picture and diagram.

The flange in each instance was laid on the floor and the 16-in. pipe centered in it. A stiff putty of Smooth-On No. 1 was rammed into the intervening annular space, and next morning the separator and these connections were put into the line. After 19 years these Smooth-On joints had not leaked a drop.

Making caulked bell-and-spigot joints

OAKUM is packed into the joint in the same way as when sealing with lead, and Smooth-On No. 5 (see Page 9) is then added in layers, each of which should

be pressed in well with an iron before applying the next. When the joint is full, it should be smoothed over all the way around even with the top of the hub, and a few hours after the Smooth-On has been placed, the joint must be sprinkled or dampened with water to assure thorough hardening. Test should be made when the Smooth-On No. 5 has hardened.



Arrangement for soil pipe joints. For pressure joints, only half this depth of oakum is used, with greater depth of Smooth-On filling

Smooth-On No. 5 is handy in corners, confined places, horizontal lines and inverted fittings where caulking with lead is difficult. Its use does not require a furnace for melting, thereby reducing fire risk, and as the coefficient of expansion is the same as that of the iron pipe, the joint tightness stays perfect on heating lines subjected to temperature change, whereas lead, which expands $2\frac{1}{2}$ times as much as iron, is apt to loosen.

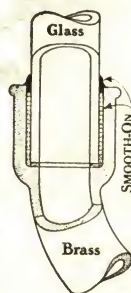
Average quantity of Smooth-On No. 5 required per inch depth of joint

2-in. pipe diam.....	6 Ounces
3 " " ".....	9 "
4 " " ".....	12 "
5 " " ".....	15 "
6 " " ".....	18 "
7 " " ".....	21 "
8 " " ".....	25 "

Making leak-proof joints between glass and metal

LEAKAGE at the joints of glass sight windows or of glass tubes, water columns, U gauges, oil gauges, oil cylinders, etc. is easily prevented or stopped by laying up the packing in Smooth-On No. 3. The Smooth-On can be kept away from the inside of the tube by first caulking in a thin layer of untreated packing.

A Massachusetts factory has a 50-hp. motor connected to an exciter for a 1000-kw. generator. The sight glasses on each

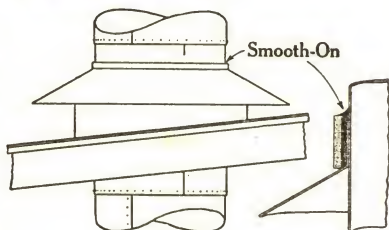


side of the motor and on one side of the exciter, for determining oil level in the bearings, were never tight. Oil leaked onto the motor shields and was drawn into the armature windings, which had to be wiped morning and noon before starting.

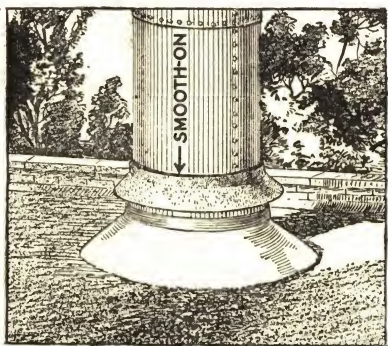
The Engineer drew all oil out, cleaned off the old putty, scraped the metal surface with sand paper and emery cloth and then packed the glass all around with a soft putty of Smooth-On No. 1. Oil was replaced about an hour later, when the Smooth-On had metallized. Ten years later the exciter had been in use every day and not one drop of oil had leaked past the repairs.

Making a watertight joint between roof and smoke stack

RAIN water can be prevented from coming through the roof at the smoke-stack opening by connecting the "umbrella" to the smoke-stack as shown. The umbrella fastening is surrounded by a strap-iron band containing



Rain-proof connection for smoke-stack hood made by a filling of Smooth-On No. 1 under a band



wedges on the inside to form an annular space, which extends a trifle higher than the top edge of the umbrella. The space is caulked with Smooth-On No. 1 which metallizes to make the entire joint virtually one solid piece.

At a factory power plant in Joliet, Ill., the heat at the roof

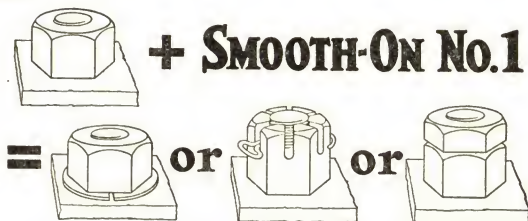
line from the stacks of two return-tubular boilers frequently set off the sprinkler heads in the fire protec-

tion system. The stacks at this point were covered with asbestos, and the hoods were packed with about everything imaginable, but rain and heat rotted out the packing, water ran down the stacks and the asbestos dropped off in chunks.

A galvanized umbrella ring about 4-in. deep was made to fit around the stack, set about 1 in. above the hood on the roof and packed with Smooth-On No. 1. This closed every crack in which rain could enter, and a year later the joint was as tight as when put on.

Smooth-On No. 1 is a good substitute for a lock nut

SMOOTH-ON No. 1, by reason of its expansion in hardening and its adhesiveness, makes a perfect lock, able to withstand vibration and big temperature changes.

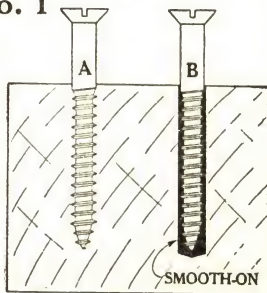


Using an ordinary nut and merely painting the threads with Smooth-On No. 1 gives a hold that will not weaken.

Holding power of wood screws set in Smooth-On No. 1

WOOD screws that have stripped out and have been reset in Smooth-On No. 1 have the same or greater holding power than when first set. Far greater strength is restored than when the screw is reset in glue or in a wooden plug driven into the old hole.

The following typical test was made with $1\frac{1}{4}$ -in. No. 6 wood screws set as solidly as possible cross-grain in an oak block.



The figures indicate the pull at which first signs of weakening appeared.

	Pounds
Screw set in wood (A, Page 101)	655
(four different locations).....	720
Average—631	723
	426
Screw set in drilled hole which barely cleared the screw threads (B, Page 101)	
(a) Hole filled with wood plug.....	162
(b) Hole filled with wood plug glued before driving.....	515
(c) Hole filled with glue.....	310
	576
(d) Hole filled with Smooth-On No. 1	623
(five different locations).....	775
Average of five tests with Smooth-On No. 1	630
665 pounds.	723

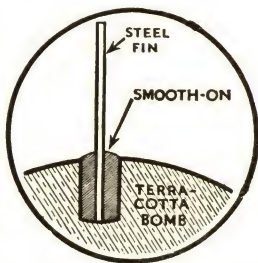
Attaching metal to Ceramics

THE ability of Smooth-On to adhere and bond perfectly between materials of widely different composition can be utilized to advantage in the manufacturing of many products.



Smoke bomb with steel fins set in Smooth-On No. 4

Terra cotta smoke bombs, for instance, are made with four steel fins for guiding flight. These fins, as shown in the detail sketch, are inserted in slots which are filled with Smooth-On No. 4 as a binder. The Smooth-On is put in as a soft putty, the fin pressed into place and the excess Smooth-On scraped off. That remaining in the slot hardens quickly and holds the fin very firmly.



Restoring pitted and rough surfaces on iron and steel castings



Before

After

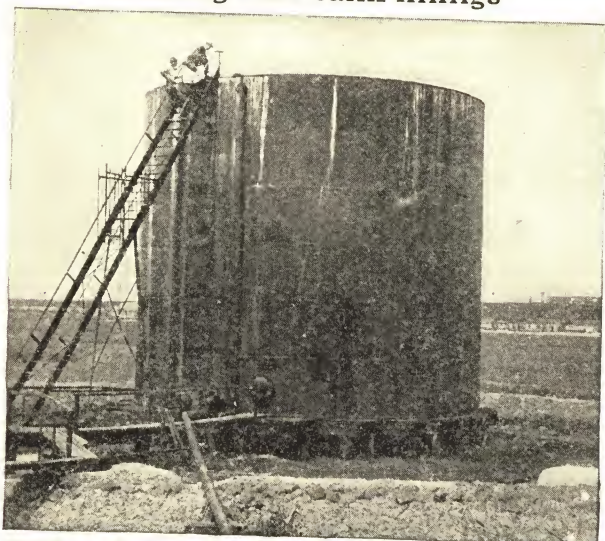
Typical result from the application of Smooth-On No. 4
to defective castings

NO MATTER how much time and care are taken in the foundry to make all castings perfect, some invariably come out of the mould with surface defects. Those castings in which the pits or other surface defects are objectionable in appearance but not otherwise, can be made substantially perfect by treatment with Smooth-On No. 4. (See Page 7.)

In the course of the year, this Smooth-On treatment saves hundreds or thousands of dollars in any foundry by making saleable at top-notch prices, castings that would otherwise be rejected or at least invite criticism.

Many prominent foundrymen make it a practice to inspect every casting and forbid shipment of those containing surface defects until after the depressions have been trued up with Smooth-On.

Setting lead tank linings



55,000-gal. lead-lined steel tank (20 ft. diameter by 25 ft. height) in which 300 lb. of Smooth-On No. 4 were used behind the lead lining to give it a solid backing at all uneven surfaces

A CID and other lead-lined tanks either must have a smooth inside surface as a backing for the lead, or extremely thick lead sheeting must be used to prevent cutting, stretching and breaking of the lining.

Perfect inside surface for solid backing can be formed by filling over all seams, corners, rivets and rough places with Smooth-On No. 4 (See Page 7) and shaping the top of this filling to a contour of easy curvature.

That this is preferable to thicker lining out of contact with the backing at critical locations was typically proven in connection with the steel tank shown above. Had the surface in this instance been left rough, lead sheeting of $\frac{1}{4}$ -in. thickness would have been required, whereas the job was actually done by laying a $\frac{1}{8}$ -in. lining over a surface made with Smooth-On No. 4.

Inasmuch as the cost of lead for linings is almost exactly proportional to its thickness, half the material cost was saved at a comparatively very small outlay for the Smooth-On. In addition to this, $\frac{1}{8}$ -in. lead sheeting could be worked much quicker than the $\frac{1}{4}$ -in. thickness, with a corresponding saving in labor.

Making smooth, iron-hard, non-dusting and water and oil-proof concrete floors

SMOOTH-ON No. 7, added to concrete in making cement floors, gives a finish which stays smooth and hard as flint under severe service.

This hard smooth finish is proof against surface disintegration and is therefore free from dusting and is water and oil-proof. These are ideal conditions for engine and boiler rooms, in factories, etc., because of the greater durability and the ease in keeping clean.

Smooth-On treatment is also particularly desirable in preventing the formation of holes on runways and stairways.

The Smooth-On may be applied according to either Specification A as described below, or Specification B on next page, according to the service.

Specification A. Floors of ordinary service including foot traffic and light trucking.

After the cement finish has been laid and is ready to float, Smooth-On No. 7 should be spread evenly over the surface, rubbed in well with a float and the whole finished with a steel trowel.

About 30-lb. of Smooth-On should be used for every 100 sq. ft. of surface covered. It may be spread either dry by hand-sprinkling as a powder, or wet by mixing with enough water to form a stiff paste and then spreading with a trowel.



Applying the Smooth-On No. 7 and finishing the floor in accordance with Specification A

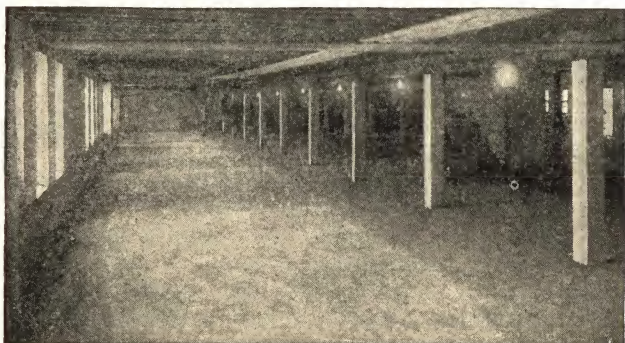
Specification B. Floors for very severe service, including heavy traffic and heavy trucking.

The floor topping should consist of a mixture in the following proportions:

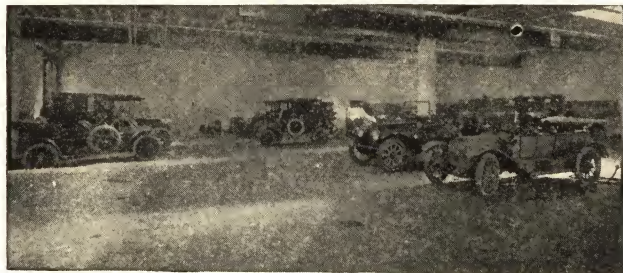
Smooth-On No. 7	25-lb.
Portland cement	100-lb.
Sand	150-lb.
Grits	50-lb.

The Smooth-On and portland cement should be thoroughly mixed together dry before adding the sand and grits. After the topping so made is placed and ready to float, more Smooth-On No. 7 should be added as per Specification A.

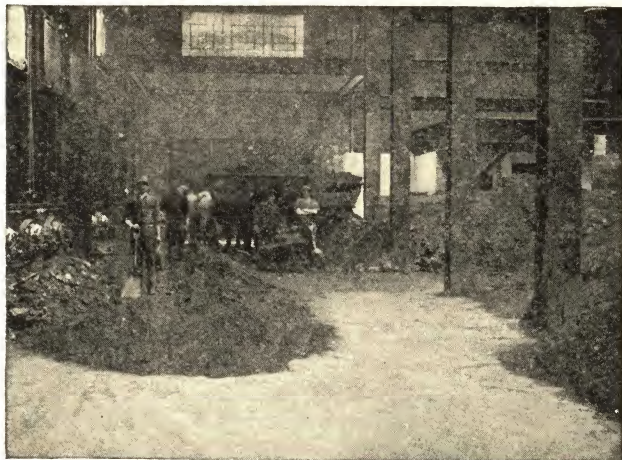
This method requires 100 lb. of Smooth-On No. 7 for each 100 sq. ft. of floor finish $\frac{3}{4}$ -in. thick.



Factory floor in low wet ground in Harrison, N. J. Made perfect by treatment with Smooth-On as per Specification A, Page 105



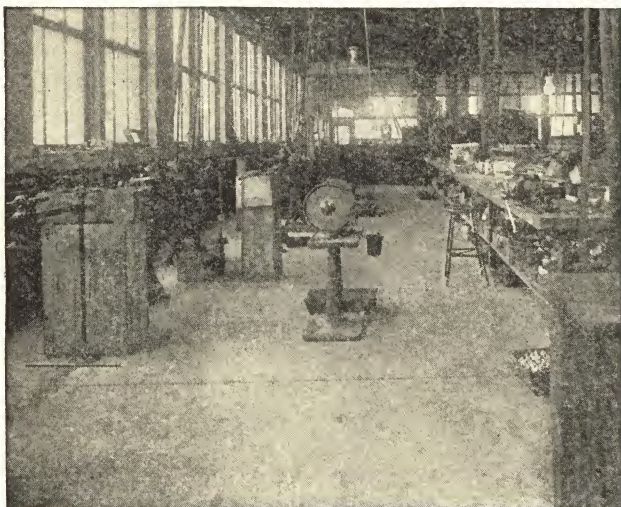
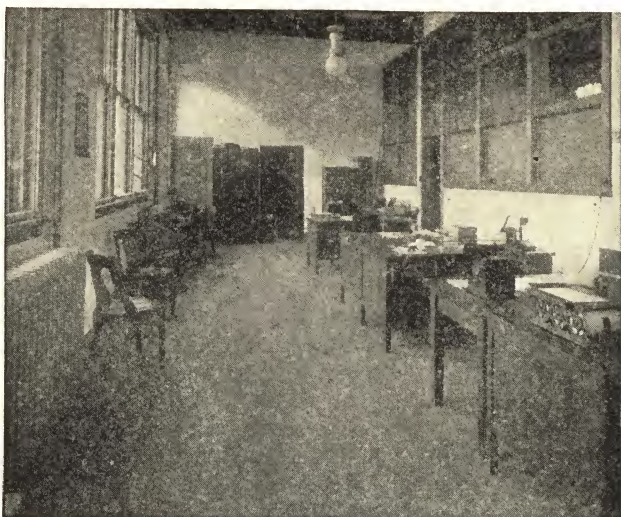
Garage floor oil-proofed:—Floor of a garage on the Grand Concourse, New York City, laid as per Specification A, Page 105. After 10 years of hard service, the owners are very enthusiastic about the results produced by the Smooth-On No. 7



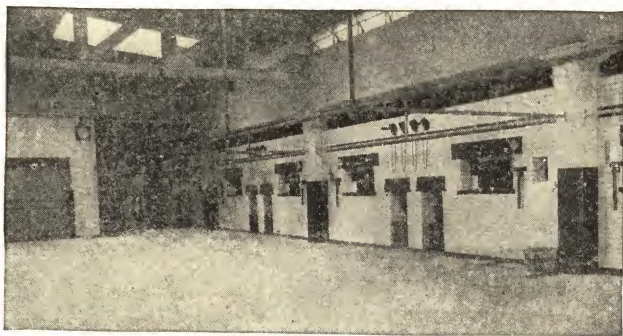
Rough usage no detriment to this Smooth-On concrete floor:—4000 Lb. of Smooth-On No. 7 put into this floor in one of the largest and best built factories in New Jersey made it wear-proof. Continual grinding from the wheels of coal trucks, and heavy iron-wheeled barrows, has left no impression after ten years of constant service



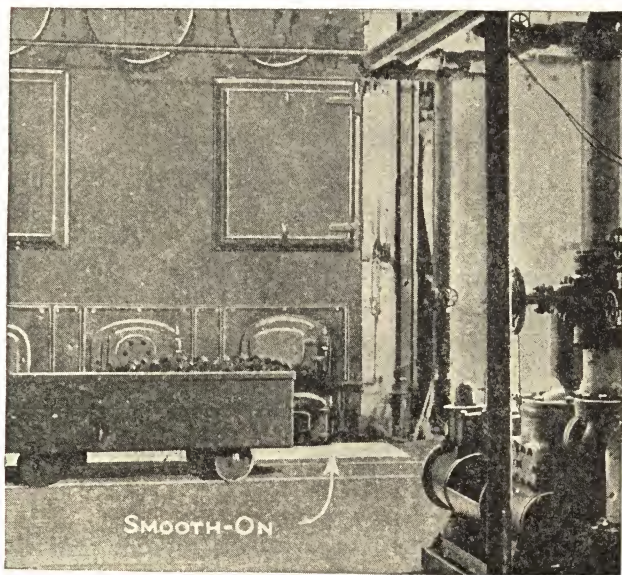
Ash chute room in a large power house in New York. Heavy trucks are continually driven over this floor, and as ashes and cinders which drop from the chutes are ground under the truck wheels and horses' hoofs, the punishment would quickly destroy ordinary concrete construction. Smooth-On No. 7 was therefore mixed into the concrete (Specification B) with satisfactory results



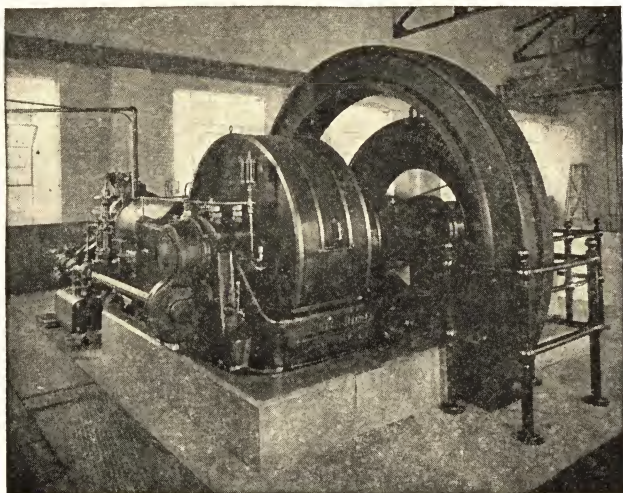
The office and machine-shop floors in this Chicago factory have been hardened with Smooth-On No. 7, as per Specification A, Page 105. These floors were flawless, non-dusting and satisfactory in every way after a year's severe usage. The owners say that in justice to their machinery alone, they would not be without Smooth-On floors; that the exceptional hardness is just what they needed; and that in enlarging the plant, all new flooring will be finished with Smooth-On



This Smooth-On concrete floor in the main room of a bakery in Brooklyn, N. Y., has withstood every onslaught for 11 years with excellent satisfaction. Smooth-On concrete floors have been in service throughout the plant for the same length of time and with equally good results. This firm is convinced that the prolonged life of any concrete floor is well worth the extra expense for the introduction of Smooth-On



Concrete floor hardened and made fire resisting:—The portion of this floor in front of and under the boilers was laid in accordance with Specification B, Page 106, to make it hard, tough and heat proof. Such a floor is never injured by water, expansion and contraction or other boiler room punishment



Smooth-On engine room floor:—This engine-room floor laid as per Specification A, Page 105, at Bloomfield, N. J., was in perfect condition after nine years, and the owners are highly pleased

Applying Smooth-On No. 7 to old cement floors.—

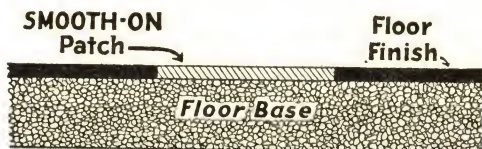
To apply a Smooth-On No. 7 surface to an old cement floor, it is necessary to either remove the old finish from the base or to lay a new finish over the old one. This new top should be at least 1 in. thick, following Specification A, Page 105, or Specification B, Page 106, according to the service.

Waterproofing old cement floors with Smooth-On

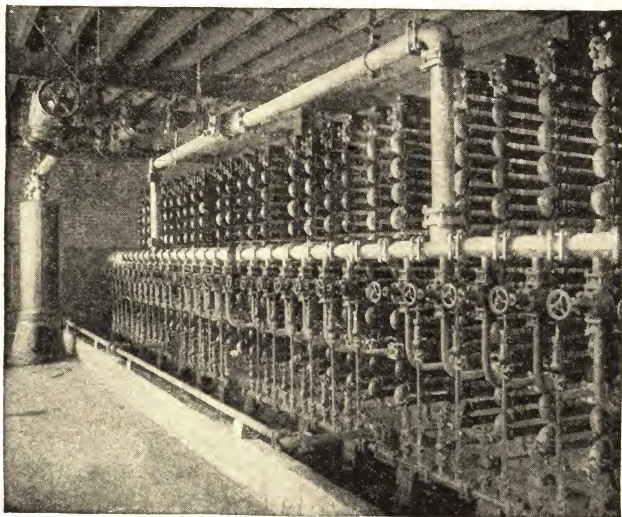
No. 7:—The floor should be painted with Smooth-On No. 7 mixed with an equal volume of water, as per Specification C, Page 115. Many basements leak at the joint where the floor joins the walls. When waterproofing floors or walls, this joint should always be examined and any cracks treated as indicated on Page 118.

"My cellar floor is below high tide and always was damp in spots. As the top wore down, conditions became worse. Since the application of about 80 lb. of Smooth-On No. 7, this floor is as dry as a nearby cellar that was proofed with tar paper and tar between cement layers, at a cost of about a thousand dollars. In fact, I consider mine better, because leakage, if any, would show up at the point of the leak, instead of at some other spot, as with tar."—R. W. SEMPLE, Sheepshead Bay, L. I.

Applying Smooth-On Iron Concrete Paint to prevent dusting of old cement floors:—Where the floor is subject to light traffic, dusting can be prevented by painting the floor with Smooth-On Iron Concrete Paint, as described on Page 11.



Patching Concrete floors:—The part to be repaired should be cut out to a depth of at least 1 in. and with as



Leaky concrete pit floor made tight:—An ice plant at Union Course, N. Y., has an ammonia condenser located over the engine room, and as the cooling water flows over the outside of the condenser pipes, an absolutely waterproof floor under them is necessary. The original plain concrete floor developed such bad cracks after short use that pails had to be placed in the engine room to catch the leakage. Repairs made with Smooth-On No. 7, as per Specification C (Page 115), stopped the trouble at once. Two years afterward, the Chief Engineer told us that this floor remained absolutely waterproof

nearly vertical sides as possible. All loose and weak concrete or stones should be cleaned away and the cavity well moistened with water to prevent the concrete from absorbing the water in the repair mixture.

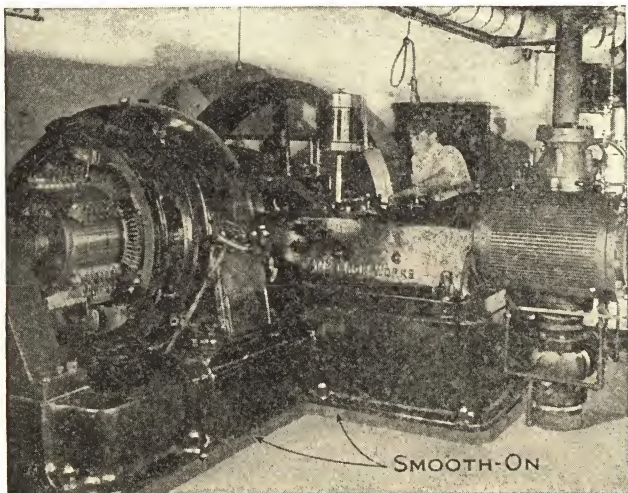
The cavity should then be tamped full of the same mixture, and the repair finished, as for extra hard floors (Page 106). The patch must be protected, and kept wet with water for several days, after which it is ready for service.

Making durable foundations for machinery

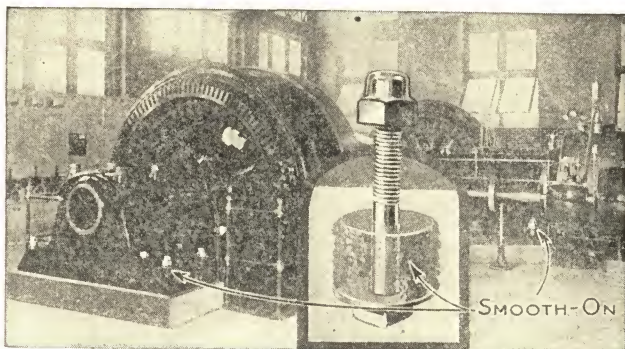
ENGINE and other heavy machinery foundations made from plain concrete are often unsatisfactory because machine oil penetrates into the concrete and vibration disintegrates the mass and permits the holding bolts to loosen.

Adding Smooth-On No. 7 to the portland cement and sand makes a foundation which is firm, solid, oil-proof, water-proof, wear-proof, durable, anchors the bolts very tightly, and can easily be kept clean.

The use of Smooth-On No. 7 mixed throughout the mass in the proportions given for heavy floors (Specifica-



A large power user in Brooklyn, N. Y., mixed Smooth-On No. 7 with concrete when making the foundation for the above engine. The Chief Engineer said that all future foundation work under his direction will be done the same way



After three years of foundation trouble with a 300-ton ice machine, a Brooklyn, N. Y., plant obtained permanent strength and tightness by using Smooth-On No. 7 in rebuilding anchorages

tion B, Page 106) is preferable, but where only a tight anchor for the bolts is desired, construction under Specification A (Page 105) and the arrangement shown above will give excellent satisfaction.

Laying a Smooth-On concrete floor over old wooden floors

WORN wooden floors can be restored to meet every requirement by covering with a Smooth-On Concrete mixture, as per Specification B, Page 106. This



This is the 48-ft. by 125-ft. floor of the third story of a New York Warehouse Building. Heavy service proved too much for the old wooden floor, so it was covered with from 2 in. to 4 in. of Smooth-On No. 7 mixture to make the new surface level

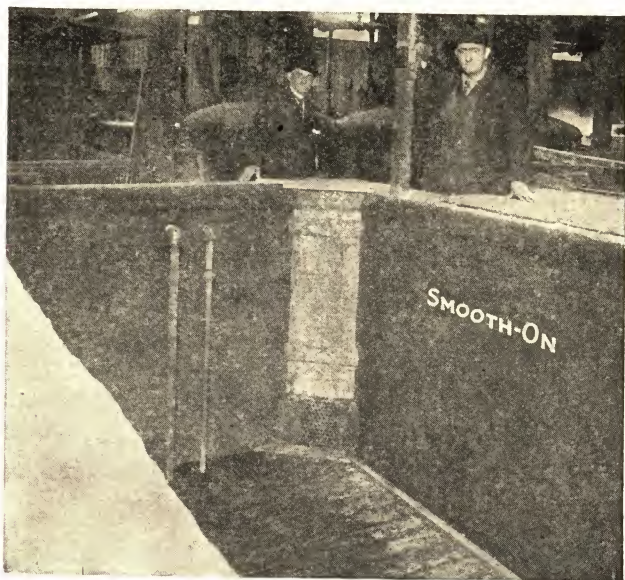


Brick wall before and after applying Smooth-On No. 7, as described on Pages 115 and 117. When hardened, the Smooth-On coating becomes brick red in color and is not impaired by sun, wind, rain, snow or ice. The Smooth-On can be applied while the wall is wet.



Stone cellar walls waterproofed: Several stone cellar walls on a large estate in West Orange, N. J. were so porous and full of holes that water poured in half an hour after every rain started. The holes in the wall were filled with Smooth-On No. 7 mixed to a stiff putty, after which the wall was given a coat of Smooth-On No. 7 as a paint. All Smooth-On was applied from the inside.

The wall has staid tight for eleven years



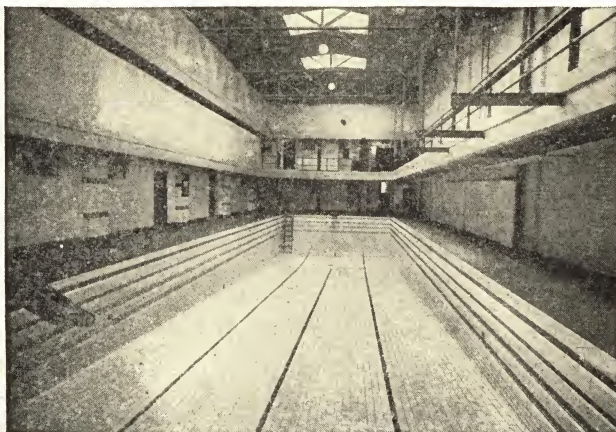
Wooden tank at Brooklyn, N. Y., waterproofed with Smooth-On No. 7:—Wooden tanks can be made tight by covering the walls and floor with Smooth-On No. 7 mixture applied as in Specification B, Page 106. The walls should first be lined with wire mesh to provide a reinforcement and hold for the Smooth-On

construction stiffens the building and gives an absolutely water-tight surface which can be washed and is easy to keep clean and free from odors.

Waterproofing walls of concrete, brick or stone

Specification C:—The portions of a wall which are out in the open may be waterproofed from the inside or the outside, but contrary to popular opinion, the sub-surface portions subjected to ground water should be waterproofed *from the inside*. This for the following several good reasons, which should be thoroughly understood:

First: Water forcing its way into the wall carries with it sand, mud, etc., which when the water subsides is deposited in the wall. Repetition of this process with every rainfall, in time fills the pores of the wall with fine silt, making it solid, because what silt gets into the wall remains there.



Swimming pool in Jersey City, N. J. Floor and walls hardened and waterproofed with Smooth-On No. 7



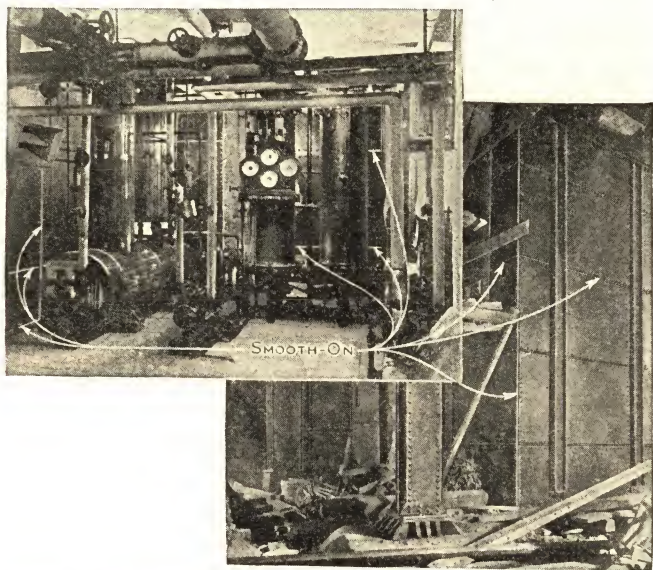
Waterproofing a filtration plant with Smooth-On No. 7:— The filter beds of the ten sections of a filtration plant at Peekskill, N. Y., were leaking and much water was lost. After removing the stone and sand used as a filtering material, an inspection was made and it was decided to waterproof the floors and walls of all sections with Smooth-On No. 7. Over 40,000 lb. of Smooth-On was used. The floors and cracks were water-proofed as described on Pages 115 to 118. The tanks were tested and found to be perfectly tight

Second: If waterproofing on the inside leaks, the faulty spot can be accurately located and the leakage easily stopped, whereas with outside waterproofing, the leak is difficult to locate.

Third: Inside waterproofing costs less than outside for both initial installation and repair, and the repair is both simpler and more dependable.

A very important advantage in comparison with other waterproofing materials which must be applied to a *perfectly dry surface*, is that Smooth-On can be put onto *any wall, wet or dry*.

The Smooth-On method of waterproofing effectively seals the open pores in the wall and is so simple that anyone can apply it. All that is necessary is to clean the surface with broom, brush or water. Keep Smooth-On No. 7 well mixed with an equal volume of water and apply the mixture to the wall with a brush, the same as



Caisson walls and floor made watertight:—Engine room and caisson cellar of a prominent insurance building in New York. The caisson cellar is subjected to a 35-ft. head of water from outside. Eleven years after these were waterproofed with Smooth-On No. 7 there was still no leakage and we were advised by the contractors that the waterproofing had given entire satisfaction

whitewash. More water may be added if necessary to thin so that it will spread well.

25 Lb. of Smooth-On No. 7 should be applied to each 100 sq. ft. of surface for ordinary pressures.

"We used Smooth-On No. 7 for water-proofing the floor and roof of the Montgomery Park Overlook and Tool House. The rough concrete surface was first painted with Smooth-On Iron Cement No. 7, which was allowed to metallize, then the finishing coat was applied. The work appears to be perfectly water-proof. The Smooth-On was extremely easy to apply and our men are well pleased with it."—CHARLES L. PITTS COMPANY, INC.



This crack shown before and after repair, withstands a heavy water pressure, and after a year's use was still perfectly tight

Repairing cracks in concrete

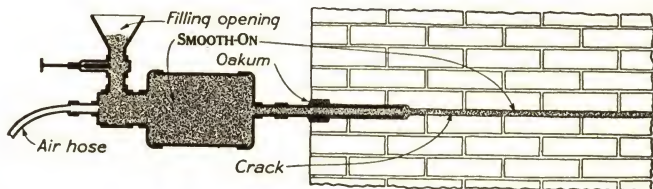
LOOSE or weak material should be removed and the crack cleaned out with water. Smooth-On No. 7 mixed with water to form a stiff putty should then be tamped into the crack and the surface smoothed off.

Cracks under pressure with water coming out, should have a bottom caulking with oakum over which the Smooth-On No. 7 may be applied. Another method is to insert a pipe in the crack, fill the balance with Smooth-On No. 7, and when this has hardened, the pipe should

be withdrawn and the hole closed with a wooden plug.

The finished job if dry should be wetted several times at intervals of two or three hours as wetting hastens the hardening of Smooth-On No. 7 and its mixtures.

Making deep cracks tight in reservoir walls



Apparatus for utilizing compressed air pressure for filling Smooth-On No. 7 into deep cracks in brick, concrete or stone walls.

THE method shown was used to repair the 1,500,000-gal. reservoir in a city in Kansas. The walls here are of brick and cement mortar and are 4 ft. thick. Due to a very heavy freeze, this wall cracked through all the way at about 5 ft. from the top. At the line of this crack, 2-in. holes were drilled 2-ft. deep into the wall, and 1¼-in. nipples without outside threaded end were caulked 10 in. into the holes. An 8-in. by 10-in. cylinder with filling opening was attached to the outside end of the nipple and connected for compressed air under 80-lb. pressure.

The cylinder was filled with a half-and-half mixture of Smooth-On No. 7 and water, which was shot into the wall by air pressure. When the wall was filled at one point, the cylinder was moved to the next nipple.

Oilproofing and gasolene-proofing concrete or brick tanks

SPECIFICATION D:—The surface should be cleaned with broom, brush or water to remove all loose material, after which the following mixture should be applied:

Smooth-On No. 7.....	1 part by volume
Water.....	1 part by volume

When mixed as above, Smooth-On No. 7 is of a consistency to apply with a whitewash brush. The Smooth-

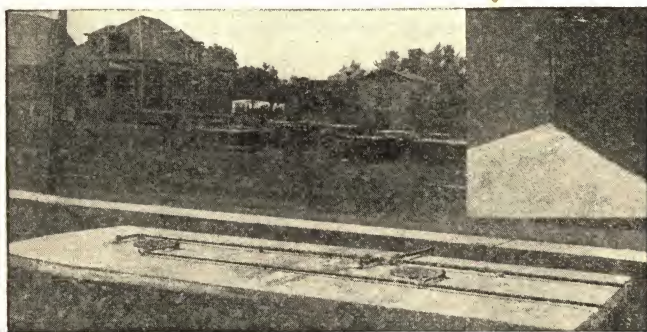
On should be kept well mixed by stirring, and water should be added if necessary to thin.

Three coats should be applied, allowing 24 hours for each to set before applying the next. Each coat will require 25 lb. of Smooth-On No. 7 to every 100 sq. ft. of surface covered.

After the last coat, a $\frac{1}{2}$ -in. plaster coat of the following mixture should be applied with a trowel and finished smooth:

Smooth-On No. 7.....	25 lb.
Portland cement.....	100 lb.
Sand.....	100 lb.

This method requires about 150 lb. of Smooth-On No. 7 for every 100 sq. ft. of surface, and will be found thoroughly satisfactory.

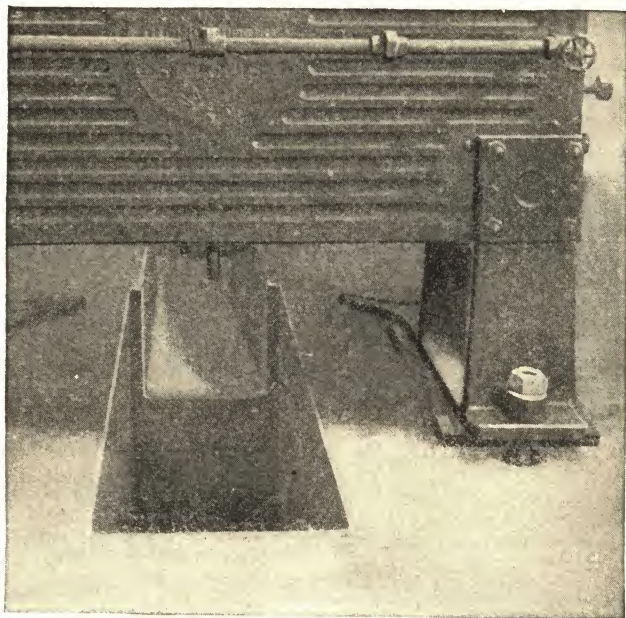


Underground concrete tanks oil-proofed:—A gas company in Minnesota stores oil in two concrete tanks, each 32 ft. by 12 ft. by 9 ft. inside. These tanks were oil-proofed with Smooth-On No. 7. The oil in both tanks was carefully measured for a long time before using from either tank, and there was no sign of leakage

Keeping ground water out of submerged pits

SEepage of water into boiler, pump or wheel pits, drainage sumps, etc. through their concrete, brick or stone walls can be entirely prevented by employing Smooth-On No. 7 either in the original construction, or later as a waterproof coating, applied from the inside. Proper methods of procedure are described under the heading, "Waterproofing walls of concrete, brick or stone", Page 115.

Typical new construction and repair work are described in the captions of illustrations.



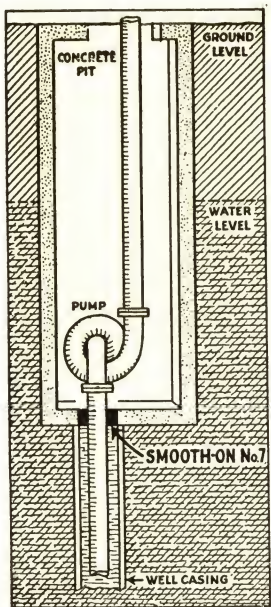
Floor and machinery pits waterproofed:—When the engine, wheel and drain pits at a plant in Jersey City, N. J., were excavated, water in each case came to the floor level and would fill the holes once in 12 hours.

Water was pumped out; forms for 6-in. walls placed, a 6-in. bottom laid and tamped, and a floor form placed and fastened to hold it in place. The side forms were then filled, thoroughly spaded, and tamped to take out all voids. As the walls were erected, the interior space was filled with water to equalize pressure on the inside and outside. The pits were allowed to stand for seven days, when the water was taken out, the inside forms removed, the outside forms cut off just below the surface, and the floor joined to the pits with Smooth-On No. 7 mixture.

The floor and side walls were made from a mixture containing 25 lb. of Smooth-On No. 7 to every 100 lb. of portland cement, together with the usual quantity of sand.

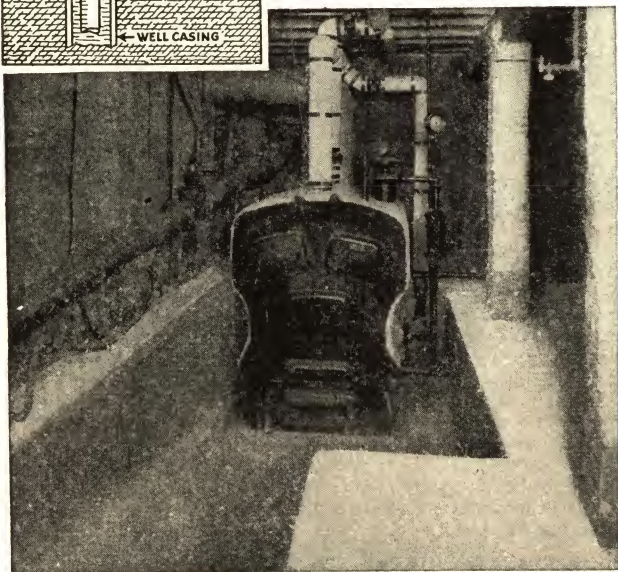
The use of Smooth-On proved entirely successful, making the whole construction absolutely watertight

"I have used Smooth-On Iron Cement No. 7 for Water-proofing concrete and brick elevator pits and also for hardening and water-proofing floors and walls, with excellent results."—CHARLES S. WHAN, Concrete Specialist, Hoboken, N. J.



Concrete pump pit water-proofed:—A hospital in California has a belt-driven centrifugal pump in a pit 17 ft. below ground level. Vibration cracked the concrete which sealed the well casing in the pit floor around the suction pipe, and in trying to effect a new seal, a piece of concrete $2\frac{1}{2}$ in. by 8 in. was broken out. The water level in the ground rose, and enough water came into the pit to submerge the pump.

The pit was pumped out by hand, and the water level was lowered below the floor, by running the power pump. A piece of wood pushed through the break and held under the floor was used as a form, and Smooth-On No. 7 was tamped into the hole. The outside water level is 8 ft. above the break, but the pit is watertight



This boiler pit is below sewer level and leaked so badly that it usually contained 6 to 12 in. of water. Since the application of Smooth-On No. 7 there is no more leakage or dampness



This tunnel, which is part of a New York subway system, is below high-water mark and is subjected to much ground water. The caulking grooves are packed with Smooth-On No. 7, and the bolts with Smooth-On No. 3.

Waterproofing sub-aqueous tunnels

ABSOLUTE and permanent watertightness of the interior is a first essential in vehicular tunnels under the beds of rivers, and wherever any portion is below the ground water line. Smooth-On has been much used for this purpose in constructing various cast-iron sectional and plate-lined tunnels of New York City subways.



The New York Subway tunnel under the Harlem River. The sections were completely assembled on the surface before lowering to the river bottom. Watertightness at all stay-bolts was secured by using Smooth-On No. 3.

In assembling the sectional type of wall, the caulking grooves, about $\frac{1}{2}$ -in. wide and 1-in. deep, are filled with Smooth-On No. 7. The procedure usually adopted is to mix the dry Smooth-On to the proper consistency with water, and carry it in pails to the mortar boards of the men who force it into the grooves with trowels.

All bolt holes are made watertight by placing under the head and nut of each bolt, washers which have been coated with Smooth-On No. 3.

In plate-lined tunnels, Smooth-On No.

3 is applied with a brush to the screw threads of the stay-bolt nuts and to the faces of stay-bolt heads and nuts on both sides of the sheets.

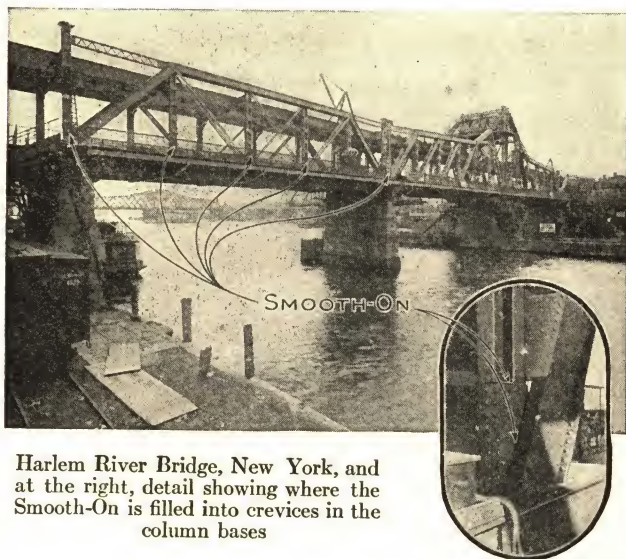


Close-up of stay-bolt work

Water and weather-proofing joints between metal and concrete, stone, slate, glass, wood, etc.

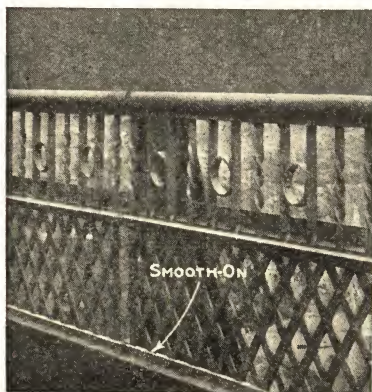
STRUCTURAL iron and concrete:—Joints between metal or metal and concrete usually open up slightly from working of the parts and the temperature changes of varying weather. Ordinary paint, tar preparations and putty worked into the cracks harden and are comparatively short lived. The ultimate result is severe corrosion and decay, as many have found to their sorrow.

Smooth-On No. 6 (see Page 9) which expands and contracts with the metal, is particularly successful in preventing this condition. It does not shrink or draw away from either side, entirely excludes moisture, and does not interfere with free working of the metal members.



Harlem River Bridge, New York, and at the right, detail showing where the Smooth-On is filled into crevices in the column bases

Corrosion of bridge parts prevented with Smooth-On No. 6:—In rebuilding the above bridge Smooth-On No. 6 was used in small spaces between plates, and where large spaces inside the column bases were filled with concrete. At the latter location a groove around the top of the concrete and next to the steel was filled in with Smooth-On, so that after the concrete had set and pulled away from the steel, the seal of Smooth-On prevented the entrance of moisture. Smooth-On protection in such places is proof against any kind of weather



The Hudson County Boulevard Bridge over the Pennsylvania Railroad at Jersey City, N.J., presented a common problem, in that water collected between the riveted angle irons along the bottom of the side railing. Painting the openings and then filling with Smooth-On No. 6 has proven a very satisfactory solution

New York subway kiosks are protected by Smooth-On No. 6:—Smooth-On No. 6 was first applied to subway kiosks in New York in 1906, and after a one-year test was found satisfactory for filling open cracks in the iron work and between iron and concrete. Since that time, most of the station entrances have been similarly protected



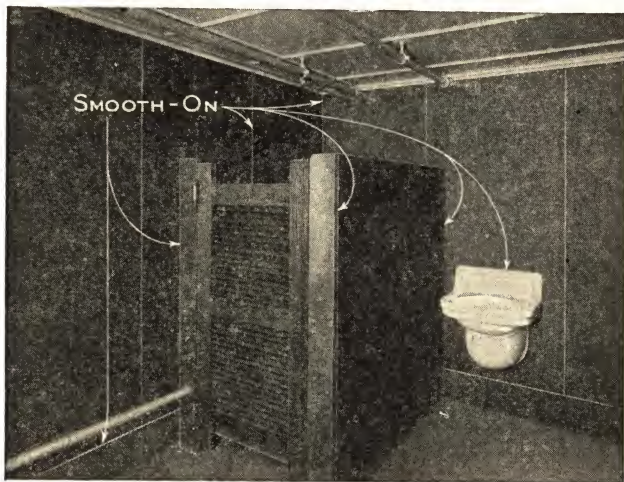
Joints between metal and wood:—Decay of wood and corrosion of metal from rain, snow and ice at these joints on exposed structures is best prevented by Smooth-On No. 6 (see Page 9). The method of use adopted by the New York elevated railway lines for preserving the steps and iron work of station stairways can be applied to advantage in many locations.



Stairway of a New York elevated railway station protected with Smooth-On No. 6

Moisture collecting in the spaces between the ends of the wooden stair treads and the supporting steel beams of these stations originally caused much trouble. The ends of the treads would decay and the iron work corroded severely, the latter disfiguring and weakening the center of the steel beam step support at each end of the treads.

To overcome this, a space $\frac{1}{8}$ -in. wide is now left between the ends of the wooden treads and the sides of the supporting steel beams. This space is filled with enough Smooth-On No. 6 to make a fillet at the surface of the tread. The joint so made between the wood and steel is thoroughly tight in both hot and cold weather and entirely prevents corrosion and decay.

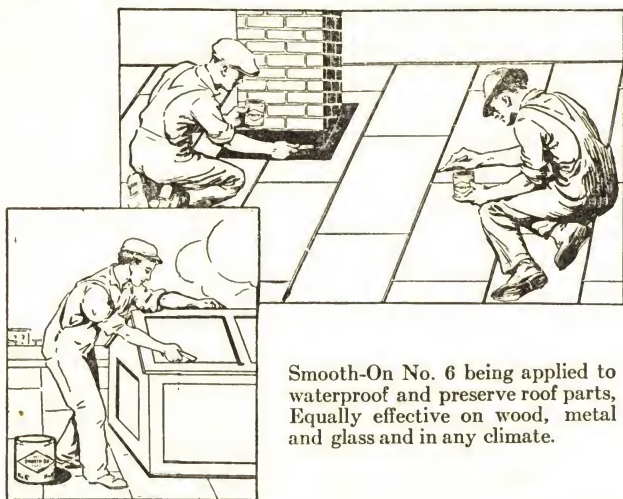


All joints between slate blocks in many toilets in New York elevated railway stations are made with Smooth-On No. 6. This construction greatly aids in making a water and vermin-proof room which is easily washed out and kept clean and free from odor

Slate work:—Smooth-On No. 6, being the same color as slate and having very good bonding qualities in metallizing, makes joints between slate blocks tight, smooth, free from cracks and neat in appearance.

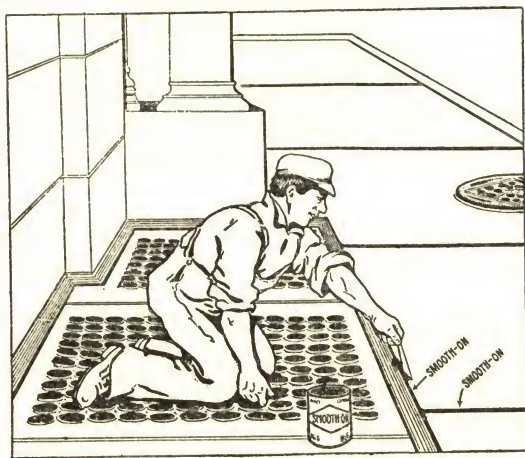
Metal roofs and skylights:—Smooth-On No. 6 (see Page 9) applied to the joints of metal roofs and chimney flashing and for glazing wooden or metal skylights

insures thorough and permanent watertightness and is an excellent protection against corrosion and decay.



Smooth-On No. 6 being applied to waterproof and preserve roof parts, Equally effective on wood, metal and glass and in any climate.

Vault lights:—Smooth-On No. 6 (see Page 9) should be used for setting the glass discs in iron vault-light frames and for making the joints between frame and paving.



Vault lights set with Smooth-On No. 6 remain watertight

Pointing and repairing brick and concrete chimneys

PROGRESSIVE disintegration at the cracks and open and defective surfaces are effectively stopped by a filling of Smooth-On No. 6 (Page 9). The work may be done while the chimneys are hot.



Concrete chimneys of a Washington, D. C., power plant. Pointed with Smooth-On No. 6

Making a rigid foundation or backing between solid parts of different contour

TWO irregular metal parts can be fitted together or metal may be fitted rigidly against masonry work by tamping Smooth-On No. 4 solidly into the intervening space. Upon metallizing, the Smooth-On forms a thoroughly rigid support or base, making the two parts virtually one. The exposed surface of the backing can be modeled to pleasing contour, and when the whole

is painted, the job has every essential of neatness and good workmanship.

Many thousands of pounds of Smooth-On No. 4b have been used in this way by the Fire Department of the City of New York, for adapting fire alarm boxes to electric light poles, building structures, etc., as shown.

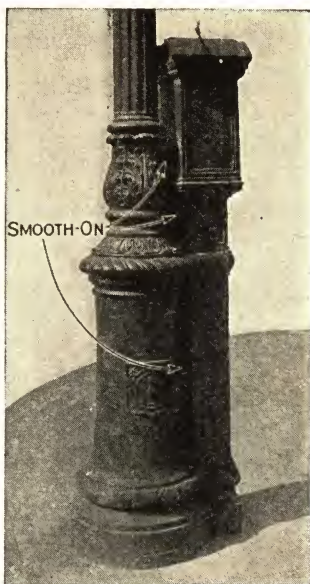
Automobile and motor truck repairs

DETAILED information on these repairs is given in a special booklet, "How to make automobile repairs with Smooth-On." Sent free on request.

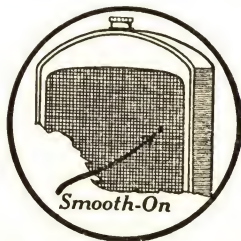
Radiators:—Smooth-On No. 1 stops radiator leaks quickly, easily and permanently with radiator full or empty, hot or cold, and without putting inside anything that can clog the circulation.

For leaks in tubes or honeycomb, the Smooth-On is mixed to a stiff putty, rolled into a small ball and pressed firmly against the leak and into the opening. For interior pipe leaks, the Smooth-On should be packed firmly around and into the defect with a blade or screwdriver.

Leaks at a seam should be opened with a knife, and a stiff putty of Smooth-On forced in and the excess scraped off with a knife. The seal so formed will be neat and durable.



Fire alarm box held firmly to electric-light pole by a Smooth-On backing

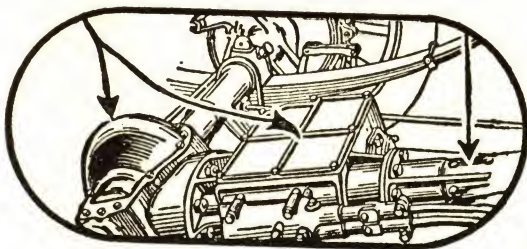


Radiator leaks stopped with Smooth-On



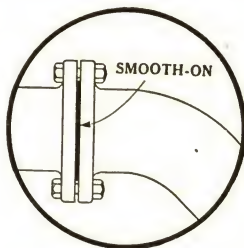
Hose connection made tight

Radiator hose connections will stay tight if laid up with Smooth-On No. 1 and clamped in the usual way.



Cracks in differential and gear box made tight

Cracked water jackets and crank, gear, differential and circulating-pump cases may be repaired as directed on Pages 59 and 75.

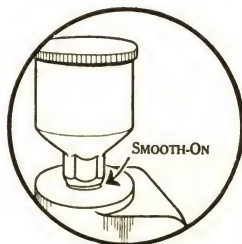


Smooth-On makes gaskets tight

Gaskets in the engine will stay perfectly tight when painted with Smooth-On No. 3. Those in the exhaust lines should be covered with a soft putty of Smooth-On No. 1.



Tank leaks stopped



Grease cup made tight

Leaky gasoline tanks and lines can be made tight by forcing a putty of Smooth-On No. 1 into the leak, or coating defective threads with Smooth-On No. 3.

Loose nuts, grease cups, hub caps and hub bolts:—Cleaning the threads and coating with a thin paste of Smooth-On No. 1 will prevent loosening and backing off from vibration and road shocks. It pays to make one job of resetting every grease cup on the car.

Loose head-light posts, spring-shackle bushings and door hinges will stay tight when set with Smooth-On No. 1.

Leaky tire pumps (hand type) will stay tight if the base threads are laid up with Smooth-On No. 1.

Household repairs

HOME uses of Smooth-On are constant and practically unlimited. The commoner ones are described in our 32-page booklet, "How to make home and automobile repairs with Smooth-On" which will be sent free on request. This booklet covers the following and many other subjects:

Repairing cracks and leaks in house-heating boilers, fire pots, stoves, radiators, water, gas and sewer pipes, sinks, tanks, iron pots, oil and gas burners, etc.

Repairing leaks in sheet-metal pails, pans, ovens, stove pipes, flush tanks, kerosene containers, stoves, lamps.

Tightening loose handles on cutlery, umbrellas, canes, hammers, tools, drawers, door knobs, brooms; tightening loose casters; setting loose pins in wooden lawn-mower rollers, etc.

Anchoring fence posts, stanchions, machine foundation bolts, pipes, etc. in concrete; anchoring screws of door handles, hinges, locks, hooks, etc.

Stopping leakage at skylights, chimney flashings, and vault lights.

Waterproofing inside and outside walls, boiler and drain pits, concrete ponds, septic tanks, etc.

Making hard waterproof floors for cellars, barns, garages, etc.

SMOOTH-ON

REG. U. S. PAT. OFF.

Smooth-On Iron Cements are never sold in bulk. All packages of the genuine bear the trade mark Smooth-On and the name Smooth-On Manufacturing Co.

The trade mark "Smooth-On" is registered in every important industrial country.

General Index

Abraded metal surfaces, restoration of.....	51, 82-87
Anchoring cylinder linings.....	87
Anchoring foundation bolts.....	113
Ammonia leakage, stopping of.....	25
Attaching metal to ceramics.....	102
Automobile repairs with Smooth-On.....	75-7, 130
Bell-and-spigot joints.....	9, 98
Boilers, steam.....	47-54
Boilers, low-pressure steam.....	56-57
Boilers, locomotive.....	55, 56
Boiler blow-off connections.....	51
Boiler breeching.....	54
Boiler Chimneys.....	129
Boiler flanges.....	36, 51
Boiler flue sheets.....	49, 50
Boiler hand-hole and manhole covers.....	52, 53
Boiler headers.....	50
Boiler mainstay braces.....	53, 55
Boiler patches.....	48, 49
Boiler pits.....	120-122
Boiler seams.....	45, 47, 48
Boiler shells, tapped openings in.....	52
Boiler smoke stacks.....	100
Boiler staybolts.....	53, 55
Boiler-room floors.....	107, 109
Brass piping.....	18
Brickwork water and oil-proofed.....	115, 119
Bridge parts, weatherproofing of.....	125
Cable code.....	16
Casings, cracked.....	63, 70, 71
Castings, porous.....	78
Castings, filling of pitted surface.....	103
Caustic soda lines, joints on.....	21
Centrifugal pumps.....	35, 36, 70, 71
Ceramics attached to metal.....	102
Chimney flashing.....	128
Chimney pointing and repairing.....	129
Clamps, pipe.....	14, 21
Code, telegraph and cable.....	16
Coils, heating.....	28
Concrete floors.....	105-113
Concrete floors laid over wood.....	113
Concrete joints with metal.....	124
Concrete machinery foundations.....	110, 112, 113
Concrete pits.....	111, 116, 117, 120-122
Concrete walls.....	114, 115
Concrete, water and oil-proofing cracks in.....	111, 114-119
Condensers.....	83, 84
Copper kettles.....	39, 74
Corroded iron sewer pipes.....	87
Corroded surfaces, restoration of.....	51, 82-87
Cracks in concrete, waterproofed.....	118, 119
Cracks in metal, stopping leakage at.....	59-78, 80
Cracks in boiler shells.....	48-50
Cracks in valves and fittings.....	80-82
Cracks in low-pressure boilers.....	56, 57
Cracks in casings.....	63, 70, 71
Cracks in cylinders.....	63-65, 67, 75
Cracks in cylinder heads.....	67-69
Cracks in fuel economizers.....	93
Cracks in pipes.....	59, 80
Cracks in pressure shells.....	63, 72
Cracks in radiators.....	58
Cracks in steam and valvechests.....	63, 65
Cracks in steam jackets.....	74
Cracks in steam separators.....	91
Cracks in steam traps.....	92
Cylinder head joints.....	41-44
Cylinder heads, cracked.....	67-69

Cylinder liners, anchoring.....	87
Cylinder, cracked.....	63-65, 67, 69, 75
Cylinder, gas and oil engine.....	65, 75, 77
Cylinder, pitted and scored.....	89
Cylinder, pump and elevator.....	67, 69
Economizers, fuel.....	93
Emergency pipe joints without fittings.....	97
Engines, gas and oil.....	75-77, 85, 86, 130
Engines, steam.....	26-30, 38, 41-44, 63-65, 67, 68
Eroded iron pipe.....	86
Expansion joints.....	91
Feed-water heaters.....	96
Filtration beds.....	116
Flange faces, steam cut or corroded.....	51, 83
Flanges that do not meet or align.....	33-35
Flanged joints.....	12, 13, 31-44
Flanged joints, large.....	37-44
Flanged joints, making new.....	31-36
Flanged joints, made tight without gasket removal.....	36-44
Flanged joints, made with oversize flanges.....	98
Flanged joints, screw thread leaks at.....	14, 21
Floors, boiler and engine room.....	106, 107, 109, 110, 112, 113, 117, 121, 122
Floors, condenser pit.....	111
Floors, concrete.....	105-113
Floors, concrete, laid over wood.....	113
Floors, concrete, factory.....	105-109
Floors, concrete, garage.....	106
Floors, concrete, iron-hard.....	105
Floors, concrete, oil and waterproof.....	105
Floors, concrete, old, treated with Smooth-On.....	110, 111
Floors, Smooth-On concrete, specifications for.....	105-119
Flue sheets.....	49
Fly wheels, squeaky.....	94
Force pumps for feeding Smooth-On.....	39
Foundations and bolt anchorages for machinery.....	108, 110, 112, 113
Foundry cement.....	7, 103
Fuel economizers.....	93
Gas-engines.....	65, 75, 84, 86
Gaskets, Smooth-On Corrugated Iron.....	12, 13
Gaskets, in lines and steam mains.....	12, 24, 31-34
Gaskets, in inlets, outlets and bodies.....	37, 39, 44, 83, 131
Gaskets, made from paper or wire gauze.....	32
Gaskets, on cylinder heads.....	41-44
Gaskets, on manhole and handhole covers.....	52
Gasolene lines, joints on.....	19
Gasoline-proof tanks.....	119, 120
Gauges, oil and water.....	99
Glass joined to metal.....	99
Handhole and manhole covers.....	52, 53
Heater-receiver.....	37
Heat exchangers.....	20
Heaters, feed-water.....	96
Heating coils.....	28
High-pressure joints.....	17, 23
High-temperature joints.....	17
Household repairs.....	132
Hydraulic accumulator repair subjected to heat.....	17
Intercooler shells.....	72
Iron pipe subjected to corrosion.....	85, 86
Jackets, steam and water.....	74, 75
Joints, at short nipples and engine inlets.....	22, 25-28
Joints, between irregular metal parts.....	129
Joints, between metal, concrete, stone, wood, etc.....	124, 129
Joints, between glass and metal.....	99, 124
Joints, between rough cast plates.....	96
Joints, between smokestack and roof.....	100
Joints, in brass piping.....	18
Joints, in caustic soda lines.....	21
Joints, in metal roofs and skylights.....	127
Joints, in oil and gasolene lines.....	19
Joints, in slate-work.....	127

Joints, in steam lines.....	23, 24, 28, 31, 35
Joints, bell-and-spigot.....	98
Joints, pipe, emergency without fittings.....	97
Joints, pipe, emergency with oversize fittings.....	98
Joints, flanged.....	31-44
Joints, screw-threaded.....	18-31
Joints, cylinder-head.....	41-44
Joints, expansion.....	91
Joints that do not align or come together.....	33, 34
Kettles, steam.....	74
Liners, cylinder.....	87
Linings, lead for tanks.....	104
Links for reinforcing cracks.....	60
Lock nuts.....	101
Locomotive boilers, cylinder-saddle joints, mainstay braces, smoke-box covers and seats, smoke-stack bases, staybolts.....	55
Loose pulley bearings.....	95
Machinery foundations.....	108, 112, 113
Mainstay braces, boiler and locomotive.....	53, 55
Manhole covers.....	52, 53
Metal attached to ceramics.....	102
Metal attached to concrete.....	124, 129
Metal roofs.....	127
Motor truck repairs.....	75-77, 130
Nipples, short.....	22
Oil burner joints.....	57
Oil engines.....	65, 75, 77
Oil lines.....	19-20
Oil-proofing tanks.....	119
Oil stills.....	20
Patches, boiler.....	48, 49
Patching concrete floors.....	111
Patch plates for cracks.....	48-50, 61-71, 75, 80, 81, 87
Pipe clamps.....	14, 21
Pipe and pipe fittings breaks.....	59, 80-82, 87, 97
Pits on castings.....	103
Pits, concrete.....	111, 117, 120-122
Pits, submerged pump and boiler.....	120, 122
Pits, waterproofed.....	115, 120-122
Porous castings.....	78
Pump casings, centrifugal.....	70, 71, 83
Pump cylinders and heads.....	67, 69
Radiators, steam and hot water.....	58
Renewable seat rings.....	29, 31
Reservoir walls waterproofed.....	119
Riveted seams.....	45, 47
Roofs, metal.....	127
Roof connections at smoke stacks.....	100
Rough surfaces on castings.....	103
Screw-threaded joints.....	18-31
Screws, wood, increasing holding power of.....	101
Seams, riveted boiler and tank.....	45-47
Separators, steam.....	91
Sewer pipe, iron.....	86
Shafting, wear at pulley bearings.....	95
Shells, cracked.....	48, 49, 63, 70-73
Shells, eroded.....	84
Skylights.....	127
Slate work, joints in.....	124, 127
Smoke-stack joints.....	100, 129
Smooth-On Nos. 1 and 2.....	4, 5
Smooth-On No. 3.....	6
Smooth-On Nos. 4a and 4b.....	7, 8
Smooth-On Nos. 5 and 6.....	9
Smooth-On No. 7.....	10
Smooth-On Iron Concrete Paint.....	11
Smooth-On Weight per cu. ft.....	14
Smooth-On Standard packages and shipping cases.....	15
Smooth-On Corrugated Iron Gaskets.....	12-13
Smooth-On Pipe Clamps.....	14, 21
Smooth-On under high pressures and temperatures.....	17

Smooth-On used in place of a lock nut.....	101
Smooth-On vs. welding.....	62
Staples for reinforcing cracks.....	60
Staybolts, boiler.....	53, 55
Steam boilers.....	47-57
Steam engines.....	26-28, 30, 41-44, 63-65, 68
Steam jackets and kettles.....	74, 75
Steam radiators.....	58
Steam separators.....	91
Steam traps.....	92
Steam turbines.....	70
Straps for reinforcing cracks.....	60
Subway kiosks weatherproofed.....	126
Sumps and submerged pits.....	120-122
Tank linings, lead.....	104
Tank seams and joints.....	46, 96
Tanks, gasoline and oilproofing of.....	119
Tanks, wooden, waterproofing of.....	115
Tapped openings in boiler shells.....	52
Telegraph and cable code.....	16
Threaded joints.....	18-31
Threaded joints with oversize fittings.....	98
Tunnels, waterproofing of.....	123
Vacuum lines.....	90
Valve breaks.....	73, 80, 82
Valve seat rings, removable.....	29
Vault lights.....	128
Walls, concrete, waterproofing of.....	114, 115
Water-jackets.....	75, 77
Waterproofing cracks in concrete.....	118, 119
Waterproofing pits, filtration beds, etc.....	116, 120-122
Waterproofing reservoir walls.....	119
Waterproofing tunnels.....	123
Waterproofing floors and walls.....	105-122
Waterproofing wooden tanks.....	115
Weatherproofing structural metal parts.....	124-128
Weights of Smooth-On per cu. ft.....	14
Welding vs. Smooth-On.....	62
Wood floor covered with concrete.....	113
Wood screws set in Smooth-On.....	101
Wood tanks, waterproofing of.....	115

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